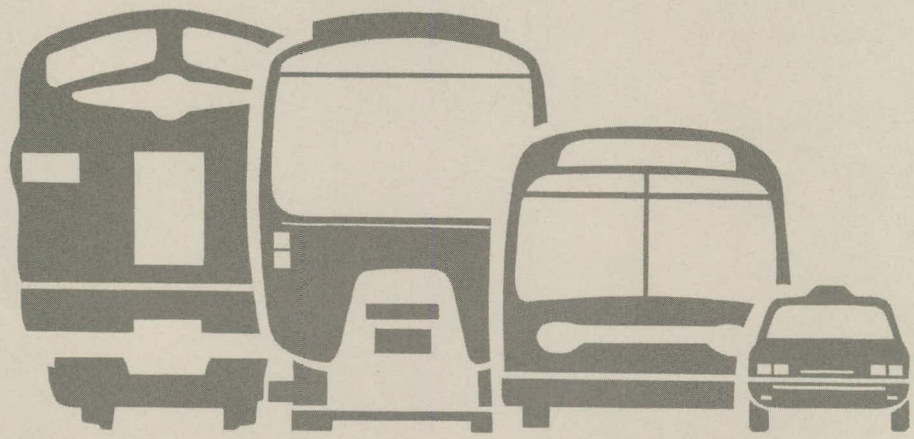
L'ENCADREMENT INSTITUTIONNEL DES SYSTÈMES D'INFORMATION SUR LES DÉPLACEMENTS DES PERSONNES DANS LA RÉGION MÉTROPOLITAINE DE TORONTO

Rapport de mission



Gouvernement du Québec
Ministère des Transports
Direction générale du transport
des personnes et des marchandises

Gouvernement du Québec
Ministère des Transports

FICHE ANALYTIQUE DE RAPPORT

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L'encadrement institutionnel des systèmes d'information sur les déplacements des personnes dans la région métropolitaine de Toronto

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But de l'étude, recherche et renseignements supplémentaires

Résumé du rapport

Le présent rapport présente les principaux éléments et conclusions d'une mission à Toronto d'une équipe de la Direction générale du transport des personnes et des marchandises. Le but de cette mission était de prendre connaissance du mode de fonctionnement et de l'encadrement institutionnel et financier des enquêtes sur la mobilité des personnes (Enquêtes O-D) dans la région de Toronto.

On retrouvera dans le présent document une présentation sommaire des informations recueillies à cet égard ainsi que quelques observations sur la comparaison entre la situation montréalaise et torontoise.

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Enquêtes O-D

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Rapport de mission

Publication réalisée à la
Direction générale du transport des
personnes et des marchandises
du ministère des Transports du Québec

Cet ouvrage a été préparé par
la Direction du développement
du transport terrestre des personnes

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Directeur du développement
du transport des personnes

Martin Noël
Jean-Pierre Primeau
Pierre Tremblay
Service des systèmes d'information

1. La mission

1.1 Contexte et but

Les enquêtes Origine-Destination sur les déplacements des personnes dans la région de Montréal ont connu depuis 1970, et particulièrement depuis 1987, une évolution technologique et un changement d'attitude des institutions concernées qui amènent le ministère des Transports à réfléchir sur d'éventuelles modifications de l'encadrement institutionnel et financier de ces enquêtes.

Depuis 1970, la Société de transport de la Communauté urbaine de Montréal mène tous les quatre ans une enquête Origine-Destination sur les déplacements des personnes dans la région de Montréal. Suite aux enquêtes de 1974, 1978 et 1982, la S.T.C.U.M. transmettait sur support informatique les résultats validés accompagnés d'autres informations périphériques nécessaires à leur compréhension et leur analyse. En 1987, la S.T.C.U.M. a décidé pour diverses raisons de limiter l'étendue des informations rendues disponibles et de reporter leur transmission.

Cette situation a amené le Ministère, et plus précisément le service des Systèmes d'information qui est responsable de ces données, à amorcer une démarche de réflexion qui lui permettrait de redéfinir les modalités de sa participation et la nature de son implication dans la réalisation de la prochaine enquête qui, vraisemblablement, devrait se réaliser en 1992.

Une rencontre à Toronto avec les principales personnes impliquées dans les enquêtes O-O-D a été considérée comme une des étapes de ce processus de réflexion car l'expérience torontoise est, à plusieurs égards, riche en enseignements. En effet, la nature et l'étendue de l'enquête sont très comparables à ce qui se fait à Montréal tout en se situant dans un contexte institutionnel fort différent.

Le but de la mission était donc de prendre connaissance du mode de fonctionnement et de l'encadrement institutionnel et financier des enquêtes Origine-Destination dans la région de Toronto. Plus précisément, les membres de la délégation québécoise étaient intéressés à connaître les modalités de mise en commun des ressources dans la réalisation de l'enquête ainsi que les modalités d'accès aux données colligées.

Dans le présent rapport, les auteurs ne se limiteront pas à faire état de l'expérience torontoise comme telle mais établiront également un parallèle avec l'expérience montréalaise des enquêtes O-D. Cette comparaison constante entre les deux agglomérations urbaines permettra de dégager avec plus de justesse les leçons que nous devons tirer de ce qui fait à Toronto et permettra aux lecteurs qui ne connaissent pas très bien le contexte montréalais de comprendre les raisons qui ont amené les auteurs à insister sur tel point plutôt que sur tel autre.

1.2 Organisation de la mission

La rencontre entre les représentants du ministère des Transports du Québec et leurs hôtes ontariens s'est tenue le 31 mai et le 1er juin 1990 à Toronto.

Afin de favoriser un échange plus libre et de permettre une connaissance plus précise du point de vue de chacun des organismes impliqués, il a été décidé de rencontrer successivement les représentants des diverses institutions retenues.

1.3 Personnes et organismes rencontrés

Ministère des transports de l'Ontario

Kevin Pask
Director
Municipal Transportation
Policy/Planning Branch

Murray Mc Leod
Manager

Doug Smith
Policy Planner

James Wong
Policy Advisor

Bill Rharney
Policy Advisor
Transportation Demand Research Office

Toronto Transit Commission

William Dawson
Superintendant
Service Policy

Regional Municipality of Peel

Ali Mekky
Senior Planner
Planning Department

Consultants

David F.Crowley
Tranplan Associates

Data Management Group
University of Toronto

Professor Gerald N. Steuart
Professor Eric J. Miller
Peter M. Dalton

Metropolitan Toronto Planning Department

Martin Seeking
Planning Systems Supervisor

1.4 Membres de la délégation québécoise

Yvon Parenteau
Directeur
Développement du transport
terrestre des personnes

Jean-Pierre Primeau
Chef
Service des systèmes d'information

Pierre Tremblay
Chef de la division Modélisation
Service des systèmes d'information

Martin Noël
Analyste en transport
Service des systèmes d'information

Gérard Chagnon
Chargé de mission
Service du développement des politiques

2. Aperçu du contexte institutionnel de Toronto

L'évolution des enquêtes sur les déplacements des personnes dans la région de Toronto est directement reliée au contexte institutionnel qui l'encadre. C'est pourquoi, nous présenterons, en premier lieu, les différentes institutions qui jouent, de près ou de loin, un rôle dans les enquêtes sur les déplacements des personnes.

En effet, dans la perspective où les membres de la délégation québécoise se sont rendus à Toronto pour tirer quelques leçons utiles à leur réflexion sur l'encadrement des enquêtes Origine-Destination, il devenait d'autant plus pertinent de se pencher sur le contexte institutionnel de Toronto.

2.1 Ministère des Transports

Le ministère des Transports de l'Ontario a un mandat comparable à celui du Québec. Sa structure interne, dans le secteur d'activités qui nous préoccupe diffère en plusieurs points de la nôtre (voir ci-joint l'organigramme de la Direction générale du transport des personnes et des marchandises au Québec et celui du Provincial/Municipal Transportation Program).

Cependant, on remarquera un équivalent au Service des systèmes d'information nommé à Toronto Transportation Demand Research Office.

C'est ce service du ministère des Transports qui s'impliquera directement dans les enquêtes de 1986 et de 1991. D'ailleurs, la personne qui assumera la direction de l'enquête en 1991 est la personne qui assumait précédemment le poste de chef de ce service.

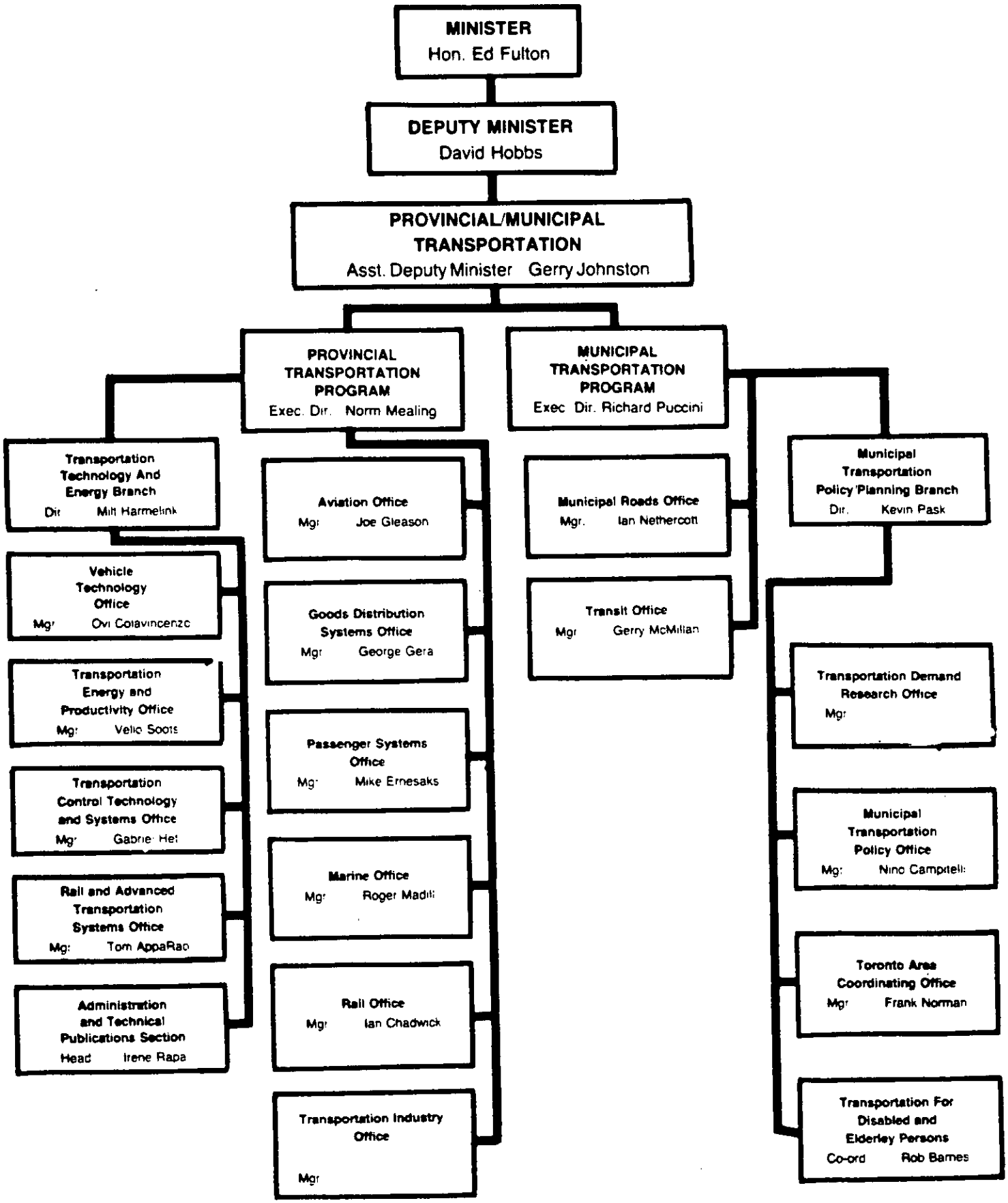
Par ailleurs, dans le secteur routier, on observe une plus grande décentralisation qu'au Québec. Ainsi, les municipalités via les municipalités régionales ont des responsabilités dans la planification, la construction et l'entretien du réseau routier tertiaire. Cette réalité a pour conséquence la présence d'un plus grand nombre de professionnels de la planification routière au niveau municipal.

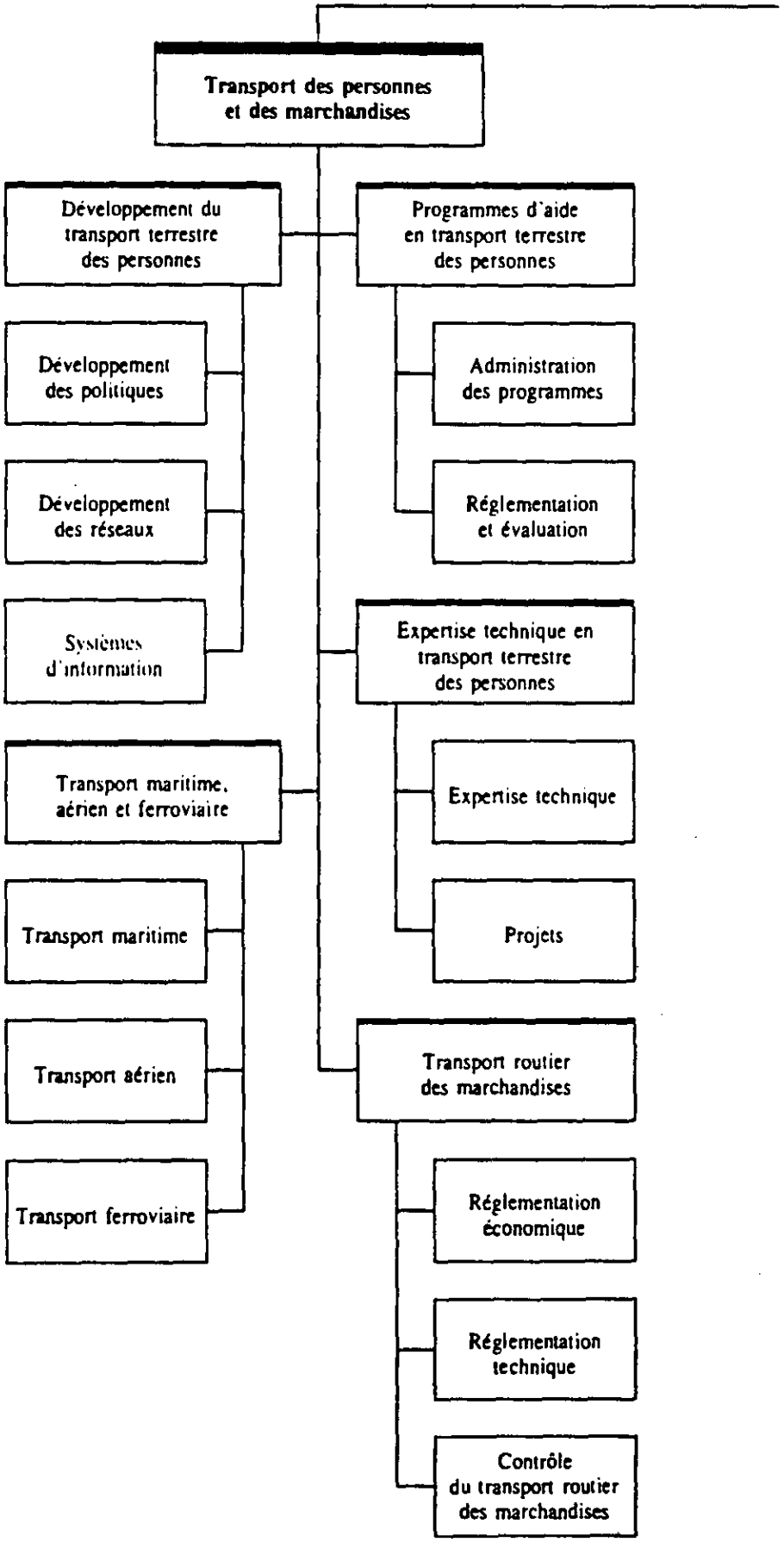
2.2 Communauté urbaine de Toronto (Metro Toronto)

La Communauté urbaine de Toronto a des responsabilités comparables à son équivalent montréalais. Il y a peut-être lieu toutefois de préciser que c'est son Service de la planification du territoire qui assume la responsabilité de la planification du transport.

A la Communauté urbaine de Montréal, on observe actuellement cette tendance à intégrer plus activement le volet planification du transport aux activités du Service de la planification du territoire.

Provincial/Municipal Transportation




Transport des personnes et des marchandises
Développement du transport terrestre des personnes
Développement des politiques
Développement des réseaux
Systèmes d'information
Transport maritime, aérien et ferroviaire
Transport maritime
Transport aérien
Transport ferroviaire
Programmes d'aide en transport terrestre des personnes
Administration des programmes
Réglementation et évaluation
Expertise technique en transport terrestre des personnes
Expertise technique
Projets
Transport routier des marchandises
Réglementation économique
Réglementation technique
Contrôle du transport routier des marchandises

2.3 Commission de transport de Toronto

Cette commission, tout comme la S.T.C.U.M., assume la responsabilité opérationnelle des services de transport en commun. A l'instar de son équivalent montréalais, la T.T.C. est maintenant dirigée par un Conseil d'administration composé d'élus municipaux.

Les liens très étroits entre les Services de la planification du réseau de la T.T.C. et de la S.T.C.U.M. ne sont pas étrangers au choix de type d'enquête qu'ont retenu les intervenants de Toronto.

2.4 Municipalités régionales

Si on inclut la Communauté urbaine de Toronto (Metro Toronto), la région métropolitaine comprend six municipalités régionales (Durham, York, Peel, Halton et Hamilton-Wentworth). Ces entités juridiques ont notamment des responsabilités à l'égard de l'aménagement du territoire et du transport dans son ensemble qu'il s'agisse des routes ou du transport en commun.

Cette situation diffère sensiblement de celle du Québec où à l'exception de Laval et, à un moindre degré, la C.U.M., il n'y a aucune entité politique qui assume, à la fois, la responsabilité de la planification du transport routier et du transport en commun. En effet, dans la région de Montréal, les territoires des municipalités régionales de comté ne correspondent pas aux territoires des autorités organisatrices de transport en commun. C'est particulièrement vrai pour les conseils intermunicipaux de transport et la Société de transport de la Rive-Sud de Montréal.

Cette séparation des responsabilités en transport rend difficile la création d'une entité régionale où, comme dans la région de Toronto, les participants ont une responsabilité de planification des réseaux de transport routier et collectif liée à l'aménagement du territoire.

2.5 Go Transit

Cet organisme gouvernemental autonome a la responsabilité du transport régional par autobus et par train. Son territoire de desserte dépasse la région métropolitaine mais tous ses services ont pour destination le centre-ville de Toronto.

Il n'y a pas d'équivalent à un tel organisme au Québec.

2.6 Toronto Area Transportation Planning Data Collection Steering Committee

Ce comité a été créé en 1977.

Sa présidence est assumée par le directeur de la planification des politiques de transport municipaux du ministère des Transports.

Des représentants des organismes suivants en font partie:

- le ministère des Transports

- Go Transit

- la Communauté urbaine de Toronto

- la Commission de transport de Toronto

- les municipalités régionales de:

    - Durham
    - York
    - Peel
    - Halton
    - Hamilton-Wentworth

Le rôle de ce comité est de:

- évaluer la nature des informations nécessaires à la planification des transports dans la région métropolitaine de Toronto;

- proposer des modalités de collecte de données;

- assurer la synchronisation des collectes de données effectuées;

- établir des normes pour favoriser les liens avec les données existantes.

2.7 Transportation Research and Data Management Group (TRADMAG)

Ce groupe de travail a été mis sur pied en 1987 par le comité mentionné précédemment (Toronto Area Transportation Planning Data Collection Steering Committee).

La présidence du Groupe est assumée par le Chef du service de l'évaluation de la demande en transport (Transportation Demand Research Office) du Ministère.

Des représentants de tous les organismes membres en font partie.

Le mandat de ce groupe de travail est de:

- voir à la création d'une base de données commune et accessible portant sur la demande en transport, l'utilisation du sol et les réseaux de transport;
- développer un ensemble d'outils communs de planification de transport (procédures, logiciels, etc.);
- mettre en place un mécanisme d'entretien des données qui permettra aux membres d'avoir accès à une base commune de données;
- coordonner les recherches en transport sur les enjeux d'intérêt commun;
- favoriser la résolution de conflits résultant de différences dans les approches méthodologiques ou dans la nature des données utilisées;
- favoriser le développement et l'expérimentation d'idées dans la collecte de la gestion des données.

2.8 Data Management Group

2.8.1 Mandat

Ce Groupe de travail a été mis sur pied en 1988 par le Tradmag en collaboration avec l'Université de Toronto dans le cadre de son programme conjoint en transport.

Le directeur du groupe est donc un professeur de l'université et plusieurs personnes qui y travaillent proviennent aussi de cette institution.

Les bureaux du Data Management Group sont situés à l'université.

Son mandat consiste essentiellement à concrétiser les objectifs du Tradmag exposés précédemment.

A ces objectifs s'ajoutent des tâches spécifiques qui visent notamment à:

- valider et analyser les données provenant des enquêtes sur les déplacements des personnes (Transportation Tomorrow Survey, Trip Diary Survey);
- établir et rendre accessible une base commune d'informations relatives au transport (réseaux de transport, utilisation du sol, mobilité des personnes);
- faciliter l'accès aux données aux membres du Transportation Research and Data Management Group (TRADMAG);
- offrir des services de traitement d'informations aux organismes participants;
- conseiller les organismes participants sur les moyens de rendre compatibles les données existantes et proposer l'ajout de nouvelles informations pour rendre le système d'information le plus à jour possible;
- s'assurer d'efficaces mécanismes de contrôle de la qualité dans le traitement et l'interprétation des données;
- mettre en place un système informatique qui permet un contrôle adéquat des données et en assure la sécurité;
- soutenir des projets de recherche sur les enjeux du transport ou sur tout autre sujet d'intérêt commun;
- promouvoir de plus grandes interactions entre les chercheurs universitaires et les praticiens préoccupés par l'utilisation des données de transport et des méthodes d'analyse de la demande dans la planification du transport dans la région métropolitaine de Toronto;
- encourager la formation et le développement de personnel qualifié tant dans la planification que les opérations du transport;
- promouvoir la diffusion des informations et des données en transport auprès du grand public et des organismes intéressés;
- promouvoir l'amélioration et le développent de la recherche et des méthodes d'analyse et de prévision de la demande dans la région métropolitaine de Toronto;
- assumer la responsabilité de la gestion de l'enquête de 1991.

2.8.2 Ressources financières

Le budget du Data Management Group est de 440 000 $ par année pour ses opérations courantes. Un budget supplémentaire de 290 000 $ par année pour une période de trois ans est accordé pour l'enquête de 1991. Le financement est assuré dans une proportion de 75 % par le ministère des Transports et de 25% par les municipalités.

2.8.3. Ressources humaines

Le Data Management Group est formé d'une équipe de sept personnes répartie en deux groupes. Un premier groupe de support technique, responsable du fonctionnement des équipements informatiques utilisés, est constitué d'un administrateur de systèmes, d'un programmeur et d'un analyste spécialisé dans les bases de données. L'autre groupe, responsable des analyses en transport, est composé d'un ingénieur et de deux analystes, dont un est prêté par Go Transit. Ce groupe est dirigé par le professeur Steuart, directeur du D.M.G. qui consacre à cet organisme la moitié de son temps de travail.

Monsieur Peter Dalton, est responsable du projet d'implantation de Emme/2. Il est prêté au D.M.G. par le ministère des Transports.

2.8.4 Ressources informatiques

Le Data Management Group s'est doté d'un environnement informatique totalement autonome, basé sur les super micro-ordinateurs de la famille SUN. Le noyau de ce système est un serveur SUN, auquel sont reliés huit terminaux graphiques localement ou à distance, via quatre modems de télécommunication. Cette architecture informatique est en voie de révision pour augmenter la puissance de calcul disponible en utilisant des postes de travail de type SPARCSTATION , au lieu des terminaux graphiques.

3. Les enquêtes sur les déplacements des personnes dans la région de Toronto

3.1 Bref historique

La dernière enquête régionale menée dans la région de Toronto remontait à 1964. Durant la période 1964-1976, il y eu très peu d'activités reliées à la collecte de données sur les déplacements.

En 1977, après une étude visant à évaluer les besoins en données sur le transport, les principaux organismes impliqués dans la planification du transport ont cheminé vers la création d'un comité permanent visant à échanger des informations et à coordonner les efforts dans la collecte de données. Il s'agit du Toronto Area Transportation Planning Data Collection Steering Committee.

Malgré ce mécanisme visant à faciliter la concertation, les organismes n'ont pas réussi de 1977 à 1982 à trouver un terrain d'entente permettant la tenue d'une enquête régionale. Chaque organisme procéda alors à ses propres enquêtes. Le Comité joua quand même un rôle dans la coordination des activités de collectes de données et dans le partage des résultats.

Les limites d'une telle approche mirent en lumière les avantages qui découleraient d'une approche régionale et globale.

C'est alors que le Comité se tourna vers la Société de transport de la Communauté urbaine de Montréal qui menait régulièrement à tous les quatre ans des enquêtes régionales depuis 1970.

Constatant la valeur de l'expérience montréalaise, le Comité recommanda la tenue d'une enquête comparable pour Toronto en 1986.

Le ministère des Transports de l'Ontario reçut favorablement cette recommandation et décida d'engager des ressources financières et humaines dans la tenue d'une telle enquête.

3.2 L'enquête de 1986 (Transportation Tomorrow Survey)

Transportation Tomorrow Survey est une enquête téléphonique menée à l'automne 1986 auprès d'environ 61 000 foyers de la région de Toronto (voir page suivante, la carte du territoire couvert). Ce nombre de foyers enquêtés représente environ 4 % des ménages de la région couverte par l'enquête. Les informations recueillies portent sur les déplacements de tous les membres du ménage un jour de semaine.

La configuration de l'enquête a été fortement inspirée des enquêtes qui sont menées, à tous les quatre ans, à la S.T.C.U.M. depuis 1970.

Les informations recueillies portent sur:

le ménage

- adresse

- type d'habitation

- nombre de véhicules automobiles disponibles

les personnes

Pour chaque membre du ménage, on demande:

- l'âge

- le sexe

- la détention ou non d'un permis de conduire

- le statut de l'emploi (temps plein ou partiel, à l'intérieur ou à l'extérieur du foyer)

- étudiant ou non

les déplacements

- modes de transport utilisés

- heure de départ

- origine

- destination

- but du déplacement

- pour les déplacements en transport en commun, des informations sont demandées sur les lignes utilisées et les points de correspondance rencontrés.

(N.B. Toutes les données à caractère spatial sont géocodées.)

Cette enquête a été l'initiative et est sous la supervision du Toronto Area Transportation Planning Data Collection Steering Committee, composé, comme nous l'avons vu précédemment, des six municipalités régionales de la région de Toronto, la Communauté urbaine de Toronto, la Commission de transport de Toronto et le ministère des Transports.

En plus d'être responsable de la décision de tenir une enquête, ce comité s'est donné pour tâche de favoriser l'échange d'information, d'établir des normes communes et de définir et créer un système de zones standard pour l'ensemble du territoire couvert.

A l'été 1985, un groupe de travail a été créé pour préparer l'enquête de 1986 et pour effectuer une enquête-pilote auprès de 1 500 répondants.

Par la suite, un Directeur général de l'enquête a été nommé pour gérer quotidiennement l'ensemble de l'opération. Des sous-traitants ont été engagés notamment pour effectuer l'enquête téléphonique comme telle.

Tout au long de l'opération, les institutions membres du comité ont affecté des ressources techniques et humaines dans chacun des six groupes de travail. De plus, on retrouve des représentants de trois ou quatre institutions dans chaque groupe. (On trouve à la page suivante l'organigramme de l'équipe affectée à l'enquête).

Cette enquête a coûté 884 000 $. Cette somme n'inclut pas les salaires du personnel régulier des organismes publics impliqués.

3.3 Trip Diary

En complément à l'enquête téléphonique, on a aussi procédé à une post-enquête par courrier qui s'adressait à un échantillon de 10 % des personnes enquêtées précédemment.

Cette sous-enquête avait un objectif de validation de l'enquête précédente. Elle visait aussi à obtenir des informations à caractère socio-économique plus détaillées afin d'être en mesure de faire des analyses plus précises sur différentes caractéristiques des déplacements. Ainsi, dans les questions relatives à l'emploi, on demandait:

- l'adresse du lieu de travail
- le poste occupé
- le type d'entreprise
- le nombre d'heures de travail par jour
- la disponibilité des services de transport en commun et l'accès à une auto
- les coûts de stationnement

Dans les questions relatives aux études, on demandait:

- études à temps plein ou partiel
- l'adresse de la maison d'enseignement
- le nombre d'heures de cours par jour ou par semaine
- le mode de transport généralement utilisé
- la disponibilité des services de transport en commun

Enfin, on demandait aux personnes enquêtées des informations sur leur revenu

Le coût de cette enquête a été de 60 000 $.

3.4 L'enquête de 1991

Il a été décidé de mener une enquête en 1991 à cause de:

- l'importance de la croissance de la demande en transport depuis 1986;
- des changements effectués dans la nature des paires de déplacements (origines et destinations);
- l'augmentation du nombre de déplacements pendulaires à l'intérieur de la région métropolitaine de Toronto;
- une croissance démographique importante dans certains secteurs périphériques;
- la nécessité d'avoir des données à jour pour être en mesure de poursuivre les travaux d'analyse relatifs à la planification et à l'élaboration des politiques;
- la nécessité d'avoir des points de repère temporels pour être en mesure de développer des modèles de prévision de déplacements;
- la pertinence de s'accorder dans le temps avec les recensements de Statistique Canada.

Tout comme en 1986, l'enquête s'effectuera par téléphone. Elle portera sur les déplacements effectués les jours de semaine. Le territoire couvert sera la région métropolitaine de recensement. On évalue actuellement diverses hypothèses d'extension du territoire d'enquête.

Le nombre de foyers enquêtés sera de 23 000 alors qu'il était de 61 000 en 1986. Cette différence est attribuable à une diminution de l'échantillon dans les secteurs où il y a eu faible croissance.

Pour les années 1990-91-92, le budget total prévu pour cette enquête est de 860 000 $.

3.5 Modes de fonctionnement

3.5.1 L'utilisation des modèles

A l'instar de la région de Montréal, les principaux modèles de simulation utilisés sont Madituc et Emme/2.

La répartition de leur utilisation est toutefois quelque peu différente.

A Toronto, Madituc est essentiellement utilisé par la TTC puisqu'il est pour le moment un modèle d'analyse (et de simulation) désagrégée des itinéraires de transport en commun.

Par ailleurs, le modèle Emme/2 est utilisé par le Data Management Group, le ministère des Transports et plusieurs municipalités.

A Montréal, l'équipe Madituc offre des services-conseils continus à la S.T.C.U.M. et joue un rôle de premier plan dans le développement de la technologie informatique soutenant les enquêtes O-D. Le modèle Madituc comme tel est donc utilisé à la S.T.C.U.M. et au ministère des Transports.

A Montréal, le ministère des Transports est le seul utilisateur de Emme/2. Ainsi avec les données d'enquêtes fournies par la S.T.C.U.M., il peut effectuer ses propres travaux de simulation et d'analyse. Il peut également offrir un soutien technique à la réalisation de certains travaux effectués pour le compte des municipalités ou des organismes publics de transport.

3.5.2 L'accessibilité aux données (Principes de fonctionnement)

Un des principaux objectifs de la tenue d'enquêtes régionales et de leur prise en charge par un comité multi-institutionnel était l'établissement d'une base d'informations commune accessible à tous.

Il faut d'abord préciser que la nature de l'accessibilité est directement reliée au statut du demandeur. Ainsi, les organismes qui supportent directement le Centre de gestion des données ont un accès télématique direct aux données sur les déplacements comme tels, aux données de réseaux et au modèle Emme/2.

En contrepartie, chaque organisme participant est responsable, pour son territoire, de la tenue à jour de son réseau de transport dans le modèle.

L'accès des consultants au système d'information est aussi possible mais avec certaines réserves.

Ainsi, cet accès n'est possible que par l'intermédiaire du Ministère ou d'une municipalité régionale. De plus, une définition plus précise des besoins est discutée entre un membre de l'équipe du Centre de gestion des données et le consultant.

Il est important de mentionner par ailleurs que cette accessibilité ainsi que les divers services qui peuvent être offerts ne sont pas nécessairement gratuits puisque le Groupe de gestion des données tend à fonctionner sur la base d'une politique de recouvrement des coûts directs.

(Pour plus de détails sur cette question de l'accessibilité aux données, on pourra consulter le document en annexe Emme/2 Access, Policies and Guidelines).

A Montréal, c'est la S.T.C.U.M. qui définit sa politique d'accès aux données puisqu'elle en est propriétaire.

Nous reproduisons intégralement, à la page suivante, la politique d'accès à l'utilisation des données que la S.T.C.U.M. rendait publique en janvier 1989.

Enquête Origine-Destination de 1987

Utilisation des données

AUTORISATION

La Société de transport de la Communauté urbaine de Montréal (S.T.C.U.M.) autorise l'utilisation des données de l'Enquête Origine-Destination de 1987 à des fins d'information et d'analyse. Cette autorisation ne confère à l'utilisateur, ou à l'organisme qu'il représente, aucun titre ou intérêt relatifs aux tableaux de données de cette enquête.

EXCLUSIVITE

Les données transmises à un utilisateur sont réservées à son usage exclusif, ou à celui de l'organisme qu'il représente. Aucune partie ou version quelconque des données transmises ne peuvent être transférées ou redistribuées par l'utilisateur, que ce soit dans leur format original ou dans un format modifié, et quel qu'en soit le support de diffusion.

La S.T.C.U.M. a la propriété exclusive de l'expression "Enquête Origine-Destination 1987 de la S.T.C.U.M.", qui ne peut servir que pour les données contenues dans les tableaux de l'enquête de 1987 sur les déplacements des personnes dans la région de Montréal.

RESPONSABILITE

C'est à titre de service à la communauté que la S.T.C.U.M. permet l'accès aux données de l'Enquête Origine-Destination. La S.T.C.U.M. prend tout moyen raisonnable pour assurer la qualité des données transmises. On ne pourra tenir la S.T.C.U.M. responsable des erreurs d'interprétation ou des conclusions erronées découlant de l'utilisation de ces données.

C'est à l'utilisateur de vérifier la pertinence et la logique de tous les calculs effectués, et d'assumer l'entière responsabilité des résultats de ses calculs et analyses. Toute publication des données, des résultats de calculs et d'analyses, ou des textes fondés sur les tableaux de l'enquête Origine-Destination de 1987, devra être accompagnée d'une mention de la source des données, libellée comme suit:

ACCEPTATION

L'utilisateur des données de l'Enquête Origine-Destination de la S.T.C.U.M . reconnaît et accepte de ce fait les conditions énumérées précédemment.

Il y a lieu de préciser ici que le ministère des Transports a tout de même un accès privilégié à une partie importante des données fournies sur support informatique. Toutefois, le Ministère doit quand même respecter la politique d'utilisation de la S.T.C.U.M.

Source: Enquête Origine-Destination 1987 de la S.T.C.U.M., et (nom de l'utilisateur)

Conclusion

Bien qu'à Toronto la conduite d'enquêtes Origine-Destination comparables à celles que nous connaissons à Montréal soit relativement récente, les mécanismes de concertation en matière de transport et d'aménagement sont en place depuis plusieurs années.

Une culture de collaboration technique inter-institutionnelle était un terrain propice à la mise en place de mécanismes de collaboration pour la tenue et le suivi d'une enquête régionale sur les déplacements des personnes.

Par ailleurs, comme il a été souligné par toutes les personnes que nous avons rencontrées, l'implication financière et professionnelle du ministère des Transports de l'Ontario a été déterminante dans l'établissement d'un esprit de concertation solide. En assumant une part importante des responsabilités liées à l'enquête, le Ministère était en mesure d'assurer un leadership fort et de faire appliquer ses propres règles du jeu.

Bien que l'implication financière du Ministère ait un poids important dans ce leadership, plusieurs intervenants rencontrés ont tenu à préciser que ce leadership tenait aussi à la détermination et à la vision à long terme de plusieurs personnes impliquées. Sans cette volonté incarnée dans des individus, le projet n'aurait pu être mené à terme. Cette affirmation de nos interlocuteurs ontariens nous rappelle l'importance de la composante humaine des systèmes d'information.

La délégation québécoise a été frappée par l'intérêt accordé à la transmission et à la diffusion des données et à la reconnaissance de leur caractère public. Cette réelle ouverture d'esprit ne devrait toutefois pas nous faire oublier l'implication continue des organismes membres du groupe qui ont droit à une utilisation directe des données.

Ceci nous amène, par comparaison, à exposer quelques différences fondamentales existant entre la situation montréalaise et la situation torontoise.

A Montréal, le développement des enquêtes Origine-Destination a été effectué par un organisme de transport en commun ayant une juridiction qu'on pourrait considérer comme locale.

La S.T.C.U.M., malgré les limites de ses responsabilités a toujours cru bon étendre ses observations aux modes de transport autres que le transport en commun et au territoire au-delà de son territoire immédiat.

Pour être en mesure d'effectuer son travail correctement, la S.T.C.U.M. a donc toujours dû s'assurer de la collaboration du ministère des Transports, des municipalités et des organismes publics de transport concernés.

Jusqu'à maintenant cette collaboration n'a toujours été que ponctuelle et technique dans le sens qu'aucun des organismes collaborateurs n'a été impliqué systématiquement tout au long de la démarche ni n'a contribué financièrement.

Cette limite de l'implication des partenaires peut parfois entraîner des réserves de la S.T.C.U.M. quant à l'accès direct aux données.

A Toronto, les intervenants ont décidé de confier à une équipe d'universitaires, l'entretien et l'exploitation des données d'enquête. Cette équipe d'universitaires a choisi de travailler avec le modèle Emme/2. Par ailleurs, la T.T.C., compte tenu de ses besoins de planification opérationnelle a opté pour le modèle Madituc.

A Montréal. l'équipe universitaire directement impliquée dans la tenue et le suivi de l'enquête est l'équipe Madituc qui travaille à titre de conseiller technique auprès de la S.T.C.U.M.

Au Québec, s'il était décidé de créer un centre de gestion des données en milieu universitaire, il faudrait au préalable bien définir l'implication des équipes entourant les deux logiciels qu'elles ont développés.

A Toronto, le ministère des Transports a évalué que lui incombait la responsabilité de tenir une enquête qui concernait tous les modes de transport et l'ensemble des intervenants en transport de la région. Le leadership qu'assume le Ministère dans ce dossier est tout à fait conforme à son mandat.

Le ministère des Transports du Québec se retrouve maintenant devant la tâche difficile de reprendre une bonne part du leadership qui lui revient dans le dossier des enquêtes régionales tout en reconnaissant et respectant l'expertise qu'a développée et le leadership qu'a assumé la S.T.C.U.M. au cours des années.

Enfin, on observe qu'à Toronto, plusieurs intervenants ont développé une expertise appréciable en modélisation des déplacements. A Montréal, cette expertise n'existe que chez quelques intervenants. On remarque toutefois une tendance à son développement. Là aussi le ministère des Transports du Québec devra mettre en place des modes de fonctionnement qui favoriseront ce développement d'expertise et, conséquemment, l'autonomie des intervenants.

Annexes

1) Miller, Eric J. Travel Demand Modelling in the Toronto region: An Historical Overview, Rtac Annual Conference, Calgary, 1989

2) Dalton, Peter *The Transportation Tomorow Survey Data Management and research Rtac Anual Conference, Saskatoon, 1987*

Extraits des documents suivants:

3) Ministry of Transportation, The Transportation Tomorrow Survey, Toronto, Janvier 1990

First report : Design and Conduct of the Survey

4) Second report: Data Validation

5) Third report : Version 2.2 Data Guide

6) Fourth report: An Overview of Travel Characteristics in the Greater Toronto Area

7) Fifth report : Travel Survey Summary for the Greater Toronto Area

8) Sixth report : Trip Diary Survey Analysis

9) Data Management Group Emme/2 Access, Policies and Guidelines, Joint program in Transportation, University of Toronto, June 1990

N.B. Tous les documents dont on retrouve un extrait en annexe sont disponibles dans leur version intégrale au Centre de documentation (Montréal) du ministère des Transports du Québec.

Annexe 1

Travel Demand Modelling in the Toronto Region: An Historical Overview

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Paper prepared for presentation
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ABSTRACT

This paper summarizes the evolution of travel demand modelling methods and applications within the Toronto region over approximately the last thirty years. Within this historical overview, the paper discusses:

a) the modelling methods used;

b) the planning studies or policy issues analyzed using these methods;

c) the decision-making environment within which these planning efforts were undertaken; and

d) the role over time of modelling within the planning process, as well as the effectiveness of modelling efforts to play this role.

This discussion culminates in a description of current modelling efforts within the Toronto region and the implications which these efforts have for transportation modelling and planning practice within the region.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

This paper summarizes the evolution of travel demand modelling methods and applications within the Toronto region over the last thirty years.[1] Within this historical overview, the paper discusses: the modelling methods used; the planning studies using these methods; the decision-making environment within which these planning studies were undertaken; and the role played by modelling within this planning process.

In particular, Section 2 provides a chronology of the development of quantitative models of travel demand within the Toronto region from 1958 to the present day. Section 3 then discusses the evolution of the role of these models within the planning process over this thirty-year time period. Section 4 discusses current developments in quantitative modelling within the region and their implications for regional planning in the near future. Finally, Section 5 briefly summarizes the main arguments and conclusions of the paper.

2. A BRIEF CHRONOLOGY OF MAJOR MODELLING EFFORTS IN THE TORONTO REGION

The following paragraphs provide a simplified overview of the historical evolution of travel demand modelling that has occurred over the past thirty years within the Greater Toronto Area (GTA).[2] The dates shown are, in many cases, somewhat approximate, and are intended to indicate the period of major work on and use of the model.

1958-64: Toronto Traffic Prediction Model (TPM):

Developed by the Traffic Research Corporation (TRC) for the Metropolitan Toronto Planning Board, TPM was the first computer-based travel demand model for the Toronto area. It was calibrated using 1956 survey data and was used to test alternatives considered in the 1964 Metropolitan Toronto Transportation Plan. This model was not only representative of the state-of-the-art at this time, but it also contributed significantly to the advancement of this state-of-the-art, particularly with respect to modal split analysis.

1963-68: Metropolitan Toronto and Region Transportation Study (MTARTS):

The major contribution of this study was a new comprehensive travel survey conducted in 1964. 1964 survey data were used to update and validate the TPM, as direct inputs into MTARTS analyses, and as the basis for TARMS and MTTPR modelling efforts (see below).

1968-75: Toronto Area Regional Model Study (TARMS):

The TARMS model was developed by the Ontario Ministry of Transportation and Communications (MTC) to replace TPM. It was a large, four-stage model of the GTA, calibrated using 1964

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[1] The paper, in fact, focusses on modelling efforts undertaken by either Metropolitan Toronto or the Ministry of Transportation, Ontario. Modelling efforts by other regional or local municipalities are not explicitly discussed. The most notable of these undoubtedly is the extensive work which has been undertaken over the last decade or more by the Regional Municipality of Peel. In very general terms, the "Peel Model" tends to be similar in function and form to the "Metro Model" discussed in the paper.

[2] This chronology draws heavily on previous reviews contained in [1,3,6].

MTARTS data. It was the "workhorse" for regional planning analyses throughout the 1970's, including some application within the Metropolitan Toronto Transportation Plan Review (MTTPR).

1972-75: Simplified Travel Analysis Procedure (STAP):

The other model used in the MTTPR was STAP, a sketch planning model based on large zones and a simplified transportation network that enabled the Plan Review staff to examine a large number of combinations of land use scenarios and network alternatives quickly and cheaply.

1974-79: Simplified Transportation Planning Computer Package (STPCP) and Transportation Planning System (TPS):

Both STPCP and TPS are "simplified" versions of the TARMS model (TPS is essentially an extended version of STPCP). Simplifications primarily consisted of use of a coarser zone system (and hence fewer zones and network links to analyze) and streamlining the Job Control Language (JCL) procedures required to manipulate the model's data base and execute the suite of programs comprising the model. TPS formed the basis for most regional municipality modelling efforts in the late 1970's and early 1980's, including the "Metro Model".

1979-86: Metropolitan Toronto Planning Department "Metro Model":

Based on TPS, the Metro Model evolved over the years as new data and computer-based modelling methods became available. The final version of the Metro Model involved a combination of micro and mainframe-based procedures which utilized portions of TPS, UTPS (the U.S. Department of Transportation modelling package, available through MTC), and even Lotus 1-2-3 spreadsheets (for trip generation calculations). The Metro Model was used for a number of small to medium sized planning studies, perhaps most notably the series of studies which culminated in the "Network 2011" plan for transit network improvements within Metro Toronto.

1980- : Post-TARMS MTC Model:

Beginning in the early 1980's MTC began the process of developing a "simple, flexible, open" modelling system to replace the TARMS model. The result is a microcomputer-based system capable of modelling the entire TARMS region (up to 1500 zones and 20,000 network links). It uses observed Census Place-of-Residence - Place of Work (POR-POW) linkages to define base work trip flow linkages, which are then "proportioanlly updated" to yield forecast work tip flow tables. Modal splits and non-work trips are determined through relatively simple adjustments to the work trip tables. Emphasis is placed thorughout on the incorporation of professional judgement into the modelling process, including the use of "Delphi" techniques. The first application of this method was to the Ministry's "GO-ALRT" studies in the early 1980's. Since then, it has been applied to a range of regional transit and highway investigations.

1986- : Transportation Tomorrow Survey (TTS):

TTS is the first comprehensive, region-wide travel survey conducted in the GTA since the 1964 MTARTS survey. It is just now being applied to the updating of travel demand models, particularly with respect to trip generation and mode split. To facilitate the development, management and application of this data base, a Data Management Group (DMG) has been established at the University of Toronto whose full-time task is the "care and feeding" of this data base.

1987- : MADITUC:

In 1987 the Toronto Transit Commission (TTC) entered into a working agreement with the Ecole

Polytechnique of the University of Montreal to implement MADITUC, both as an operational planning tool and to assist in the on-going development of this software package. Initially developed for use by MUCTC in Montreal, MADITUC is now operational in Montreal, Toronto and Winnipeg. MADITUC was originally designed as a transit operations planning package. Given its extensive data base and its capability for very detailed network and spatial analyses, however, it is also useful for more "strategic" planning applications, most notably to date in the Toronto case, investigation of fare and service integration issues associated with cross-Metro boundary transit services.

1988- : EMME/2:

In 1988, the Metropolitan Toronto Planning Department decided to replace the Metro Model with an AT-based version of EMME/2, the comprehensive transportation planning package developed at the University of Montreal. Subsequently, they combined with the Ministry of Transportation, Ontario (MTO, formerly MTC) to purchase a mini-computer version, housed within the DMG at the University of Toronto, that both organizations could then use. Implementation of this system is well underway at time of writing.

Two basic regimes exist in terms of the "size" of these various models, as measured by the number of zones, network links, etc. built into the model. The first is the full GTA, modelled in considerable spatial detail, typically consisting of 1200-plus TARMS zones. This level of modelling detail is required primarily at the provincial (MTO) level, both for their internal, region-wide planning applications, and to provide a base system for individual regional municipality modelling efforts. The second modelling level is typically used by regional municipalities in their own planning work, and involves an increasingly grosser level of representation of portions of the GTA as one moves further from the boundaries of the municipality in question. This results in modelling systems that have less than half the number of the zones of the full TARMS system, although the size of these regional municipality zone systems has tended to increase over time, both in response to greater need to study inter-municipality network flows and interactions, and to increased computational capabilities.

A second important point to note from this brief chronology of models is the long period of time (1964-1986) during which no major data collection efforts were undertaken in the GTA. This is very characteristic of many urban areas in North America during this time period. The net result of this inactivity, however, was that models developed during this time period were dependent on increasingly old data for their development and for their "base" from which forecasts of future demand were to be based. The inevitable result of this was that models developed during this time period were progressively less able to establish their credibility as being representative of current and future travel relationships. The macro-economic changes that occurred during these years (e.g., the quadrupaling of oil prices, significant periods of both inflation and recession, etc.) as well as the dramatic growth of the GTA over this period, further emphasize the desperate need which the region had for new travel demand information by the time the TTS was finally undertaken in 1986.

A notable contrast to Toronto's long inactivity in the area of data collection is Montreal, which has undertaken major travel demand surveys every four years since the early 1970's. This emphasis on maintaining a high quality, current data base for transportation planning purposes supported and undoubtedly actively encouraged the interest in model development in both academic and government circles within Quebec that ultimately resulted in the development of both the EMME/2 and the MADITUC modelling packages. In other words, it is not at all surprising that the city that was clearly in the forefront within North America in data collection efforts throughout the 1970's and early 1980's also is the home of much of the more innovative modelling activities during this same time period.

A third major point to note concerning modelling efforts within the GTA is that, until very recently, they have been captive to mainframe computers. This dependence on mainframe batch processing resulted in extremely long turnaround times on model runs, made model development an extremely time consuming and costly process, provided a very "user-unfriendly" computing environment for transportation analysis, and, in general, made it very difficult for travel demand modelling results to be generated in the timely, cost-effective, flexibly responsive manner necessary for demand modelling to play a useful and credible role within the planning process. It is only with the "post-TARMS" MTC model and the more recent adoption of EMME/2 by Metro and MTO (in combination with the implementation of MADITUC by the TTC) that a "modern" computational environment has been achieved within the GTA, which is micro- and mini-computer based, which provides "user-friendly" person-machine interfaces (including heavy reliance on interactive colour graphics for information display, input, manipulation, and editing), and which, in general, exploits current hardware and software technology in a way that enables the computer to be part of "the solution" to transportation modelling and planning needs, rather than part of "the problem".

In terms of the modelling methods employed, each of the models listed above involved implementation of relatively standard models of the four "stages" of travel demand analysis of generation, distribution, mode split, and assignment. In methodological terms, modelling efforts within the GTA can be divided into three general stages:

1. **1958-68 (TPM; MTARTS):** This was a period of major data collection efforts and of pioneering work in model development. Relatively complex generation, distribution and modal split models were developed, contributing to the evolution of the state-of-the-art of the time.

2. **1968-85 (TARMS; STPCP; Metro Model):** This was largely a period of consolidation of the work of the previous time period within major software systems, rather than the development of new modelling methods per se. Models tended to become simpler over time in order to reduce their data and computational requirements. The only major new source of data during this time period was the Census Place-of-Work data, which permitted new methods for modelling work trip distributions to be developed.[3]

3. **1986- (MADITUC; TTS; EMME/2):** The current level of modelling efforts within the Toronto region is quite high. Major new software packages (MADITUC and EMME/2) have been installed that provide state-of-the-art network analysis and modelling capabilities. At the same time, the TTS data are providing the basis for new investigations into trip generation, distribution and modal split relationships.

The one significant exception to these observations is STAP, the modelling sytem developed during the Metropolitan Toronto Transportation Plan Review (MTTPR). As opposed to all the other models discussed, which were designed for reasonably detailed analysis of fairly specific regional-level network alternatives given an essentially fixed land use pattern, STAP is a sketch-planning model designed to quickly investigate in very broad terms the travel demand implications of a wide variety of transportation alternatives implemented within a range of possible land use scenarios. STAP loosely followed the conventional four-stage modeling approach, but in very a simpified form. In particular, it was largely manually based, rather than computer based; it relied heavily and explicitly on "professional judgement" in its calculations; and it did not attempt to generate link flows on "realistic" representative computer networks, but rather simply assigned

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[3] For a detailed discussion of the use of Census Place-of-Work data for transportation modelling, see [2].

number of "policy variables" to which they were sensitive. This meant that these models were inflexible with respect to the range of alternatives and impacts which they could be used to address, as well as physically limited in terms of the number of such alternatives (and/or land use scenarios) which they could examine. These limitations, however, were not overly critical at this point in time, since the "transportation planning problem" was rather narrowly defined (and hence a broad range of impacts did not need to be considered), a reasonably well defined vision of the future existed (and hence a broad range of "alternative futures" expressed in terms of a range of land use scenarios did not need to be considered), and planning budgets and timeframes were such that one could wait for the computer modelling work to run its course and provide its answers.

Phase 2: MTTPR (1972-74):

The urban political environment, however, changed dramatically by the late 1960's. People became much more politically active and much more distrustful of the technocratic political and planning processes described above. Several factors influenced this trend, including the general liberalization of attitudes that occured during this time, as well as growing opposition to the Vietnam War (which not only politicized people but engendered a distrust of "the best and the brightest" syndrome which characterized the U.S. government's approach to the war). In the field of transportation, this "awakening" of the population took the form of the so-called "highway revolt", in which the citizens of many North American cities first questionned and then actively opposed the continuing construction of urban freeways. In Toronto, of course, this took the form of opposition to the building of the Spadina Expressway, which ultimately led in the cancelling of this partially built facility by the Ontario government in 1971.

With the cancelling of the Spadina Expressway, it became clear that the transportation plan for Metropolitan Toronto needed to be fundamentally re-evaluated. This need resulted in the Metropolitan Toronto Transportation Plan Review, which undertook a fresh and comprehensive study of the transportation needs for the Toronto region and of the alternatives and their likely impacts that might be employed to address these needs.

Given its mandate and the political context within which it was operating, the MTTPR clearly needed to examine a broad range of system alternatives. It was also in the unfortunate position of undertaking its work prior to the completion of a major review of the Metro Toronto Official Plan. Hence, it needed to be able to test these system alternatives against a range of possible land use plans. Thus, flexibility and efficient analysis of many transportation system-land use combinations were the crucial criteria for the models to be used in this study. The TARMS model simply was not flexibile or efficient enough to handle this task (although it was used to investigate certain key combinations). Thus, STAP was developed to address the MTTPR modelling needs. In order to achieve the required degree of flexibility and adaptability, STAP largely abandoned the technical rigour and computer-orientation of models such as TPM and TARMS in favour of simpler, ad hoc techniques, often manually calculated.

The result was largely successful in the sense that a wide range of policies, alternatives and land use scenarios were, in fact, analyzed with resasonable credibility, and hence the modelling exercise was able to support the overall MTTPR planning exercise in a timely and useful fashion. In the longer term, however, STAP has had limited impact on modelling within the GTA. As an ad hoc, "one shot" set of manual techniques it did not seem to provide a suitable base for further modelling work. It was also essentially a sketch planning tool rather than the sort of detailed regional "systems analysis" tool that would be required by post-MTTPR planning studies. STAP was also a "child of its times" (as, of course, all models are) in terms of the data that were available for its development and in terms of the technology that could be exploited in this development. In particular, the MTARTS data upon which it was based were already ten years old, while the 1971 Census Place-of-Work data (which would have been of considerable use to the study) were not yet

flows to abstract "spider networks" that simply indicated general patterns of flow within the system.[4]

3. MODELLING AND PLANNING IN THE TORONTO REGION

Beginning with the work leading up the 1964 Transportation Plan, through to recent planning studies such as the Network 2011 work, travel demand models have been used within the Toronto region to provide information in virtualy every major planning study conducted within the region. The nature of modelling's role within these planning exercises, however, has tended to evolve over time. At the risk of over-simplifying, modelling appears to have passed through three identifiable phases in the GTA, which can loosely be labelled in chronological terms as "pre-MTTPR", "MTTPR" and "post-MTTPR", where as discussed in Section 2, MTTPR was the Metropolitan Toronto Transportation Plan Review.[5] Characteristics of each of these phases are briefly described in the following paragraphs.

Phase 1: Pre-MTTPR (1954-71):

As with most North American cities, this era might be considered the "golden years" for transportation planning. Major data collection efforts were undertaken (1956; 1964), major modelling systems were developed (TPM; TARMS), comprehensive transportation plans were developed (the 1964 Metropolitan Toronto Transportation Plan; MTARTS), and major capital investments in the transportation network were made (subway expansion; the last freeway components built within Metro Toronto). Planning during this time period was viewed largely as a technical, apolitical exercise. This reflected the general consensus that existed at that time concerning the objectives to be achieved by the transportation system as well as the means and modes to be used to accomplish these ends. It also reflected a generally technocratic approach to government that neither expected nor desired much in the way of public input or debate (with the public largely happy with this state of affairs as long as they perceived that they were receiving "good government"). It also undoubtedly reflected the existence of strong political leaders who possessed clear and forceful ideas concerning Toronto and how it should grow into the future.

Transportation demand modelling as an identifiable form of analysis was created by and flourished within this technocratic planning environment. It generally was seen as a necessary and useful component of the technical process of generating the information base required for rational transportation decision-making. Considerable money, time and effort went into the development and use of these models. Partially this reflected simple need: urban transportation planning was in the process of defining itself as a discipline during this time period, and the data collection and modelling work was as important in terms of gaining basic understandings concerning how transportation systems "work" as it was in terms of the forecasts which were ultimately generated. Partially, this reflected the less constrained fiscal environment of this "pre-inflation" era. But it also reflected a faith in the utility of quantitative modelling on the part of the planners and decision-makers of the day.

The models developed and used during this time period were technically rigorous (given the state-of-the-art of the time), but computationally burdensome, data intensive, and limited in the

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[4] For a description of STAP, see [5].

[5] Although many people have characterized the evolution of planning in the Toronto region in similar terms, this particular classification is largely based on a similar categorization advanced by Dr. Richard Soberman in various unpublished lectures and seminars at the University of Toronto.

While these limitations were forgivable within the planning environment of the 1950's and '60's, they are less so today. Planning study budgets and timeframes tend to be more limited, resulting in the need to produce forecasts quickly and in a timely manner. A far wider range of impacts (many of which are not transportation system impacts per se) need to be addressed. The variety of modes that must be considered as options within today's system is much greater than twenty years ago (commuter rail and bus, "mixed modes" involving transit usage with auto access, walk and bicycle modes within the central city, etc.). And the political fragmentation of the planning process results in far greater challenges of the technical credibility of modelling results than was once the case.

It can be argued that modelling and modellers lost a fair bit of credibility within the planning process during this time period because the "same old models" simply did not address the needs of the "new" planning process. This is not a criticism of the modellers themselves, who generally did a good job given the data, methods and computers available to them during this time. The "fault" for this state of affairs also, I believe, lies partially with the planning process itself, which, at least within the GTA during this time period, tended to be unfocussed, less than comprehensive, and did not always seem to appreciate the need for good quality base data and forecasts as one of its fundamental components.

4. THE CURRENT SITUATION AND FUTURE POTENTIAL

Starting in about 1987, Metro Toronto in particular recognized that its current modelling capabilities were suffering from a "credibility gap". Further, they recognized that their modelling system was not representative of the current modelling state-of-the-art, which has made considerable advances in the past decade, particularly since the advent of microcomputers.[7] To rectify this situation, the following program has been undertaken:

1. In the Fall of 1987 a detailed "systems review" was undertaken to assess the Metro Toronto Planning Department's analysis needs and the state-of-the-art available for addressing these needs. This review recommended acquisition of an AT-based version of the EMME/2 transportation modelling package and the redevelopment of the demand sub-models (generation, distribution, etc.) using 1986 TTS data as well as 1971, 1981 and 1986 Census Place-of-Work data, as appropriate.[3]

2. Based on these recommendations, Metro Planning acquired EMME/2 in late 1988. MTO subsequently decided to join with Metro in the acquisition and use of EMME/2. A minicomputer was acquired and housed at the Data Management Group, University of Toronto and EMME/2 was installed on this machine to facilitate multi-user access by Metro, MTO and the DMG. A "Phase I" model development project was undertaken by the DMG under Metro and MTO sponsorship to develop new, geocoded road and transit networks for use within the EMME/2 system, as well as to undertake the general implementation and testing of EMME/2. This project will be virtually completed by the time of this paper's presentation.

3. "Phase II" of the model development is just beginning at the time of writing of this paper. It will involve, in the first instance, the calibration of fairly conventional trip generation, distribution and modal split models for implementation within the EMME/2 system. It will also identify areas in which further model improvements

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[7] For a review and discussion of this state-of-the-art, see [3,4].

available. It is also interesting to speculate concerning the form that STAP might have taken (and the impact it might have had on future modelling efforts) if current micro-computer technology had been available to MTTPR staff and consultants, rather than the cumbersome mainframe, batch-processor computers of the day.

The one important exception to this generalization concerning STAP's lack of impact on later modelling efforts relates to its treatment of trip purpose. Prior to STAP, GTA models tended to model a range of trip purposes (e.g., home-based-work, home-based-shopping, home-based-other, non-home-based-other, etc.) in detail, typically with separate trip generation and distribution models for each trip purpose. Given the dominant role played by home-based-work travel during the morning peak period (the planning period of interest in the MTTPR analyses), STAP focussed almost exclusively on modelling home-based-work trips, which were then "factored up" to account for other trip purposes. Further, home-basaed work trip generations were modelled as simple functions of the employed labour force and employment distributions, rather than as more complex functions of population, land use, etc. This approach greatly simplified and streamlined the modelling process, significantly reduced the model's data requirements, and focussed the modeller's attention squarely on the processes of most significant interest to transportation investment decision-making. Given all of these practical advantages, this emphasis on morning peak period, home-based-work travel was retained in virtually all subsequent GTA modelling efforts. Indeed, this emphasis was reinforced once Census Place-of-Work data finally became available, which permitted far more detailed analyses of work trip commuting patterns than had previously been possible to do.

Phase 3: Post-MTTPR (1975-1986):

MTTPR is the last comprehensive transportation planning study undertaken to date in the GTA. Partially this reflects a trend away from long-range planning in favour of shorter range, project-oriented planning. It also reflects the emergence during the 1970's of the regional municipalities surrounding Metro Toronto (Halton, Peel, York and Durham), which have transportation planning mandates and agendas of their own. For good or ill, this has fragmented transportation planning within the GTA, particularly relative to the 1950's and '60's, when Metro Toronto had explicit planning jurisdiction for its hinterland. And, it may well reflect a weaker political vision and leadership over this time period concerning transportation in particular and, more generally, the evolution of the Toronto region as a whole.

As indicated in Section 2, travel demand model development during this time period was largely uninnovative, involving a return to the TARMS type of large-scale, four-stage mainframe-based modelling system. These newer versions of essentially the same old models were somewhat more efficient than their predecessors, due to the use of streamlined operating system procedures and grosser zone systems, as well as due to the emphasis on home-based-work travel discussed above. They also incorporated new information (such as 1971 and 1981 Census Place-of-Work data and, within Metro, new 1979 and 1980 survey data[6]) as it became available, and occassionally introduced relatively minor modifications to the modelling methods used (e.g., replacement of gravity trip distribution models with methods for proportional updating of "base" trip tables, etc.). In general, however,these models still suffered from the same weaknesses as their predecessors: computational-intensiveness, inflexibility, limited policy sensitivity, and poor "turn-around times".

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[6] The 1979 Home Interview Survey and the 1980 Place of Employment Survey were small-sample surveys designed to provide some updated travel information. Perhaps the primary use of these data was the use of the 1980 Place of Employment Survey data to calibrate a simple disaggregate logit mode split model.

5. SUMMARY AND CONCLUSIONS

This paper has attempted to briefly sketch over thirty years of transportation demand modelling efforts within the Greater Toronto Area (focussing within this sketch on two of the major "players" over this entire time period, the Ministry of Transportation, Ontario and Metropolitan Toronto). This thirty-year time span can very crudely be divided into three periods: a "pioneering" period from approximately 1958 to 1968, during which new modelling methods were developed and during which many of the techniques still in use today were introduced; a long period of "consolidation" (1968 to the early or mid 1980's) during which modelling methods changed relatively little, except in terms of becoming somewhat simpler in formulation and easier to use; and a very recent "current era", which has to date consisted of relatively rapid adoption of new computer technologies and software packages and a general rejuvenation of interest in travel demand data collection and model development. In assessing this evolution of modelling within the GTA, its relationship to the planning process, and the current state in which we find ourselves, the following general conclusions are noteworthy:

1. With the important exception of user-equilibrium assignment techniques first introduced in the mid-1970's, the actual modelling methods used have changed surprisingly little since the early 1960's. This undoubtedly reflects the high quality of the initial efforts of the pioneers in the modelling field. It also reflects the complexity of processes being modelled and hence the difficulty with which practical improvements to the modelling state-of-practice can be achieved. Nevertheless, improvements in modelling methods -- especially with respect to trip distribution and modal split – are required if high standards of model credibility and policy sensititivity are to be maintained and, hopefully, improved.

2. Improved data bases and significantly improved computational environments provide a near-revolutionary improvement in the modelling capabilities (even in the absence of the methodological improvements discussed above) of transportation planners in terms of the breadth, depth and quality of the analyses which can be undertaken, as well as in the efficiency and timeliness with which such analyses are executed.

3. It appears that the credibility of models and modellers within the GTA planning and decision-making process eroded during the late 1970's and early 1980's as the capabilities of the models and the needs of the decision-makers gradually became more and more "out of synch". Many technical, organizational and political factors influenced this development, which tended to result in a debilitating "feedback loop" within which a loss in perceived relevance to the planning process resulted in less financial and organizational support for modelling (and associated functions like data collection and maintenance), which would mean reduced capabilities for usefully responding to planning needs, and so on.

4. This "downward spiral" has now been halted, largely due to the efforts of modellers and planners within the GTA who have successfully made the case for and then executed major new data collection efforts (TTS) and implemented major new modelling systems (MADITUC and EMME/2). These recent trends undoubtedly also reflect the current planning environment within the GTA, in which major decisions concerning the transportation system must be made in the near future and in which the need for an improved information base for decision-making cannot be ignored. The result is a "window of opportunity" for modellers to re-establish their relevance within the planning process and to make a useful and essential contribution to the on-going transportation debate within the GTA.

are required and likely to be feasible for subsequent research and development work. At minimum, this "further work" is likely to include development of more detailed models of multi-modal choice than will be possible in the earlier Phase II work. The initial Phase II work should be completed before the end of 1989, while the subsequent, more detailed model development is likely to extend into early 1990 at least.

Once fully operational, this system is expected to improve significantly the travel demand modelling capabilities within the GTA in a number of ways, including:

1. The interactive computer graphics capabilities make network definition, editing and analysis far more efficient and powerful than was previously possible. Hence, transportation analysts will be able to accomplish more in less time and will also able to display their results both more readily and in ways that are easily understood by decision-makers.

2. Modern computing power and software greatly enhance the efficiency and the cost-effectiveness of data base management and modelling activities. Many processes can be run interactively in "real time". Computationally intensive processes that still require batch processing (e.g., full network equilibrium assignments) have turn-around times of hours rather than days. The result is again, more efficient, productive use of analysts' time, and more timely responses to information needs within the planning process.

3. Improved modelling methods (such as disaggregate logit models and equilibrium assignment techniques) not only enhance the theoretical credibility of the model results, but generally also enable the models to be sensitive to a wider range of policy variables.

4. The improved data bases used to generate these models also enhance the models' credibility and policy sensitivity.

5. The availability of this modelling system at a centralized location makes it possible for different planning agencies to be using the same base data and same models for their own planning work. This will provide a consistent "factual/technical" base for planning work within the GTA which can only serve to improve the dialogue within the region. That is, it will not eliminate disaggreement among GTA members about substantive planning issues concerning alternative system needs and improvements, but it will assist in focussing this discussion on such substantive issues, rather than on the quality of the data or modelling methods used in the quantitative analysis of these issues.

The planning environment within which this modelling system will be coming "on-stream" is a particularly challenging one. The transportation system of the Toronto GTA is under extreme pressure from twenty years or more of sustained growth that has not been matched in any comparable way by transportation system improvements. The transportation system is also suffering from the lack of global vision and planning commented on in the previous section. Hence, the GTA planning community must quickly adjust to this situation, it must take a good, long, hard comprehensive look at the transportation needs of the GTA, and it must plan effectively and efficiently to meet these needs as best as possible.

Timely, credible, policy-sensitive quantitative modelling analyses must play an important role in current and future planning efforts within the GTA if they are to be successful. The system currently being put into place within the GTA has the technical potential to play this role -- something that was not necessarily the case even five or six years ago. The challenge facing modellers in the GTA is to turn this potential into fact and to demonstrate this fact convincingly to decision-makers. In turn, the challenge facing senior planners and decision-makers is to recognize that information generation, analysis and evaluation lies at the heart of planning, that this applies to quantitative information as well as qualitative, and that we do, indeed, now have the tools needed to get the job done, if we are given the support and the opportunity to do so.

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Annexe 2

THE TRANSPORTATION TOMORROW SURVEY

DATA MANAGEMENT AND RESEARCH

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CONTENTS

EXHIBITS

1.0 Overview

The Transportation Tomorrow Survey (TTS) is the name given to a comprehensive survey of travel patterns carried out in the Greater Toronto Area in the Fall of 1986. The survey consisted of telephone interviews with a 4% sample of all households in the area. Complete information was collected on the travel movements of all members of the household on the weekday previous to the interview. Interviews were scheduled to provide equal coverage for each week day.

The design and conduct of the survey were modelled very closely on the surveys carried out in Montreal by the Montreal Urban Community Transit Commission every four years since 1970. Exhibit 1 depicts the area covered by the survey and the distribution of population. Exhibit 2 provides a summary of survey statistics. Exhibit 3 lists items of information collected in the survey. Of particular note is the detailed transit route information collected. This is intended to provide for detailed analysis of ridership characteristics by individual route and is expected to replace the need for a number of on-board surveys. The total cost of the survey was $884,000 or $14.37 per completed interview. Exhibit 4 provides a breakdown of the cost.

In addition to the main telephone survey, a follow-up mailback survey was carried out for a 10% subset of the respondents to the main survey. There were two purposes to this supplementary "Trip Diary" survey. The first was to collect validation data for comparison with the main survey, by having each member of the household complete a written log of trips made on a specified day. The second was to obtain more detailed socioeconomic information about the household for analysis of trip rates and other travel characteristics. Details of the information collected in the diary survey are contained in Exhibit 5. The main survey was used to provide a stratified sample by dwelling unit type, number of persons, vehicle ownership and geographic area. An overall response rate of 53% (2974 households) was achieved. The budget for the trip diary was $60,000, not included in the main survey cost.

The TTS was the first comprehensive survey of travel patterns to be carried out throughout the Toronto area since 1964. During that time the population of the area has increased by 50%. As a result, there was an urgent need to obtain more up-to-date information for both system and operational planning purposes. Section 2 of the report discusses in more detail the transportation issues that the survey data is expected to address.

2.0 Transportation Issues

It is anticipated that data from the TTS will provide input to decisions on a number of major transportation issues in the Greater Toronto Area. Foremost is the need for capital investment in new transportation infrastructure. The population of the area is currently growing at an average annual rate of 1.4%. Only a marginal reduction in this growth rate is expected between now and the turn of the century. Employment is currently growing at about 3% annually, reflecting an increase in labour participation rate due primarily to the number of women entering the labour market. Whereas nearly all of the population growth is occurring outside Metropolitan Toronto, it is expected that about a third of the employment growth will continue to be inside Metropolitan Toronto. This distribution, together with the high growth rates, has placed severe pressures on all of the existing transportation facilities with particular concern focusing on travel across and adjacent to both sides of the Metropolitan boundary and access to the downtown core.

At the present time the different planning agencies in the Toronto areas have put forward proposals for new facilities which in total would cost in excess of $4 billion to implement. They include proposals for several new subway lines, busways, a major new highway, the construction of a number of "missing links" in the road network and expansion of the commuter rail network.

A second major issue is the degree of fare and service integration between transit properties and the need for an integrated planning strategy. Transit services are currently provided by 17 different transit properties, each with their own service area. With the rapid growth in the population area, municipal boundaries are widely perceived to have become artificial boundaries to the efficient movement of people. The TTS data is expected to provide valuable insight into the extent to which these boundaries are real barriers to transit usage. This can then be used to assess the likely impact of different options for removal of these barriers.

In addition, to the above issues which relate to specific facilities and services, there are a number of more general issues and trends which are expected to be addressed with the TTS data. These include the impact of an aging population, female participation in the labour force, part-time employment and the importance of non-work travel. It is expected that these factors could all have a significant influence on the need for transportation services, particularly public transit and peaking characteristics.

3.0 Organization

The survey was a joint undertaking of the following nine agencies:

Corporation of Metropolitan Toronto
Regional Municipality of Durham
Regional Municipality of York
Regional Municipality of Peel
Regional Municipality of Halton
Regional Municipality of Hamilton-Wentworth
Toronto Transit Commission
Ministry of Transportation & Communications, Ontario
GO Transit

75% of the cost of the survey was funded by the Ministry of Transportation and Communications and the remaining 25% was divided between Metropolitan Toronto and the participating regional municipalities in proportion to their 1985 populations. Half of the Metropolitan Toronto share was paid by the Toronto Transit Commission.

The organization and supervision of the survey was the responsibility of the Toronto Area Transportation Planning Data Collection Steering Committee (TATPDCSC). This committee was established in 1977, with the above membership, for the purpose of coordinating data collection activities throughout the Toronto area. Committee activities have included the sharing of information, the establishment of common standards and definitions and the creation of a standard traffic zone system for the entire area.

A working group of the TATPDCSC was established in the summer of 1985 and met on a regular basis once every two weeks during the preparation and conduct of the survey. A pilot survey consisting of 1500 interviews was conducted in March 1986. Following that, a General Manager and an assistant were retained to provide day-to-day management of the main survey including direction of the contractor hired to perform the field work. The General Manager was also responsible for overall control of survey expenditures.

In addition to the TATPDCSC role of providing overall direction and coordination, the members provided a significant resource both in terms of technical expertise and manpower, to assist in the conduct of the survey. To make the most effective use of this resource the working group members formed six different teams with representation from three to four agencies on each. Additional staff from the agencies were co-opted on to several of the teams as necessary, mainly to supplement particular areas of expertise. The overall management structure and the role of each team are shown in Exhibit 6. It should be noted that everyone of the teams represented a key component in the success of the survey.

A contractor was hired to carry out most of the field work. The contractor's responsibilities included the mailing of an advance letter, the conduct of the actual interviews, data entry, validation and any call backs necessary to obtain complete information. The TATPDCSC retained responsibility for survey design, geocoding of home addresses, origins, destinations and transfer points; and for the tabulation of results and subsequent analysis. A consultant was retained to develop the software for geocoding and the geocoding operation was carried out by contract staff working under the supervision of the General Manager's assistant.

The cooperative effort of the agencies involved was important not only in making the best use of the available resources but also in ensuring that all agencies have a common data base to work from in the future. It has also provided a solid base to permit consideration of more extensive centralized data management and research functions. These are considered in more detail in Section 5.

4.0 Automated Geocoding

One of the challenges in the TTS was to determine an efficient way to record locational information (such as home address and place of work, and trip origins and destinations). Previous surveys had used zone systems, such as TARMS to delineate locations. Location coding was done by manually identifying the appropriate zone, using maps and directories. The manual approach tends to be labour intensive and open to errors, but most importantly, the zonal information generated is tied to rigidly blocked areas which may not be appropriate for all studies, and may not be fine enough for some types of analysis.

Automated geocoding takes full advantage of microcomputers, to rapidly scan large arrays of address and monument information to zero in on the locational co-ordinates desired. TTS data has been coded to the UTM 6 degree system which is capable of defining longitudinal and latitudinal co-ordinates to the nearest metre. The co-ordinates actually used in the TTS give locations of the centre of the nearest blockface. In the case of a residential address, the corresponding blockface would be a point midway between intersections and set back 22 metres from the roadway centre-line. These points are described in the Area Master Files prepared by Statistics Canada. Also listed in the Area Master File are the location co-ordinates for a series of monuments or landmarks, such as the C.N. Tower in Toronto or the Eaton's Centre.

The automated geocoding system for the TTS was set up on a Convergent Technologies microcomputer system. This system

has multi-user capability such that 10 or more terminals can be simultaneously accessing the same locational data base or independently updating the same data base. The automated geocoding program, written in PASCAL, allows a user to type in a municipality and address, intersection or monument corresponding to the raw data given in the survey questionnaire. The program quickly scans the corresponding data files and within a fraction of a second responds with the UTM co-ordinates. If the location cannot be immediately determined, a number of data listings can be called upon the screen as an assist. For example, a street address range can be shown, which lists for a particular street, the addresses at intersecting streets.

Alias files are also established for matching up misspelled street names with the correct street names and for correcting the wrong type of street, for adding in street direction (e.g. Eglinton Avenue West) and for correcting a wrongly-stated municipality.

The automated geocoding system is a learning system because as the survey geocoding proceeds, more and more information is added to the geocoding data base. The monument files for the GTA began with some 300 monuments at the beginning of the TTS, and it now has over 150,000 monuments, including variations in spelling.

The advantage of this learning process is that the "hit rate" or proportion of records that are geocoded on the very first attempt, improves over the course of the survey geocoding operation. For example, the initial hit rate for the TTS was about 40%. But over the coding period, with the improvements made to the files, the hit rate improved to over 60%. Survey records that cannot be coded through the microcomputer must be coded the traditional way using maps, business directories, street directories and other reference materials.

A major cost associated with automated geocoding is for the acquisition of microcomputer equipment. A typical equipment configuration for Convergent Technology microcomputers would consist of a master workstation containing the data files and the software used to access these files and up to 10 peripheral work stations. At the present time, this equipment can be rented at a cost of about $15,000 for a six month period. Coders, typically university students can be trained to use the equipment and follow the process involved in a matter of a few days.

The additional costs associated with automated geocoding are more than offset by the greatly increased productivity of the coding staff. It is estimated that the introduction of automated geocoding for the Transportation Tomorrow Survey saved more than $60,000 in staff costs. Other advantages

include the reduced risk of manual errors (because much of the data copying onto the manual forms is eliminated), a high degree of flexibility (difficult coding returns can be done at any time) and portability (the equipment can be set up anywhere). But most importantly, the geocoded data has a higher degree of precision and can be analysed using any geographical zone system.

5.0 Future Plans

The ongoing management of the TTS data base and related analysis is being done on a co-operative multi-agency basis similar to the way the TTS survey itself was planned and carried out. The work is being co-ordinated through the Transportation Research and Data Management Group which has representation from the nine agencies involved and reports to the senior TATPDCSC committee.

The concept of central data management is to establish a core group to carry out common TTS analysis requirements, to handle the dispensing of data to the agencies involved and to carry out some of the basic research necessary to identify new patterns of travel behaviour and their underlying causal relationships. The core group is expected to consist of four to six people and will be located at the Ontario Ministry of Transportation and Communications.

Because of the need to analyse the TTS information in conjunction with other sources, a central data base system will be set up. This will include on line disk storage of all of the TTS information as well as other data, such as demographic (e.g. 1971 - 1986 Census and land use), transportation activity (e.g. cordon counts, GO Transit ridership surveys), transportation networks, zone systems, and previous travel survey data. One of the key advantages to the central data bases is consistency - all agencies will be able to draw from the same common data base.

The equipment presently being used to prepare the TTS data files for analysis is a Convergent Technologies microcomputer system with more than 15 terminals. Because of the size of the TTS data file (50 MB) and of the related data it will be necessary to have a hard disk capacity of at least 200 MB, or to reposition the TTS data base on a minicomputer system with sufficient storage capacity and processing speed.

The major events for the ongoing data base development and analysis are as follows:

- translate the geocoded address trip data into traffic zones;
- create three TTS data files for household data, person data and trip data;

- carry out logic checks on the data to track down remaining errors and resolve them;
- develop geographical expansion factors based initially on dwelling units;
- carry out various comparisons of the TTS data with other data sources (such as 1986 census, traffic cordon counts, and the Trip Diary survey) to validate the data;
- conduct analyses of the TTS data to meet the common requirements of the agencies involved. These analyses include trip generation rates, trip distribution, modal split, trip length and degree of self-containment of home to work linkages in the outlying regional municipalities.

Two major reports are anticipated, the first outlining the planning and conduct of the TTS survey (for release in August 1987) and the second to outline the results of the analysis (December 1987). In addition, a series of bulletins will be prepared to keep the participating agencies and the public informed about the overall progress of the survey programs. The most important output from the survey will be the data base itself.

Exhibit 1

SURVEY ORGANIZATION STRUCTURE

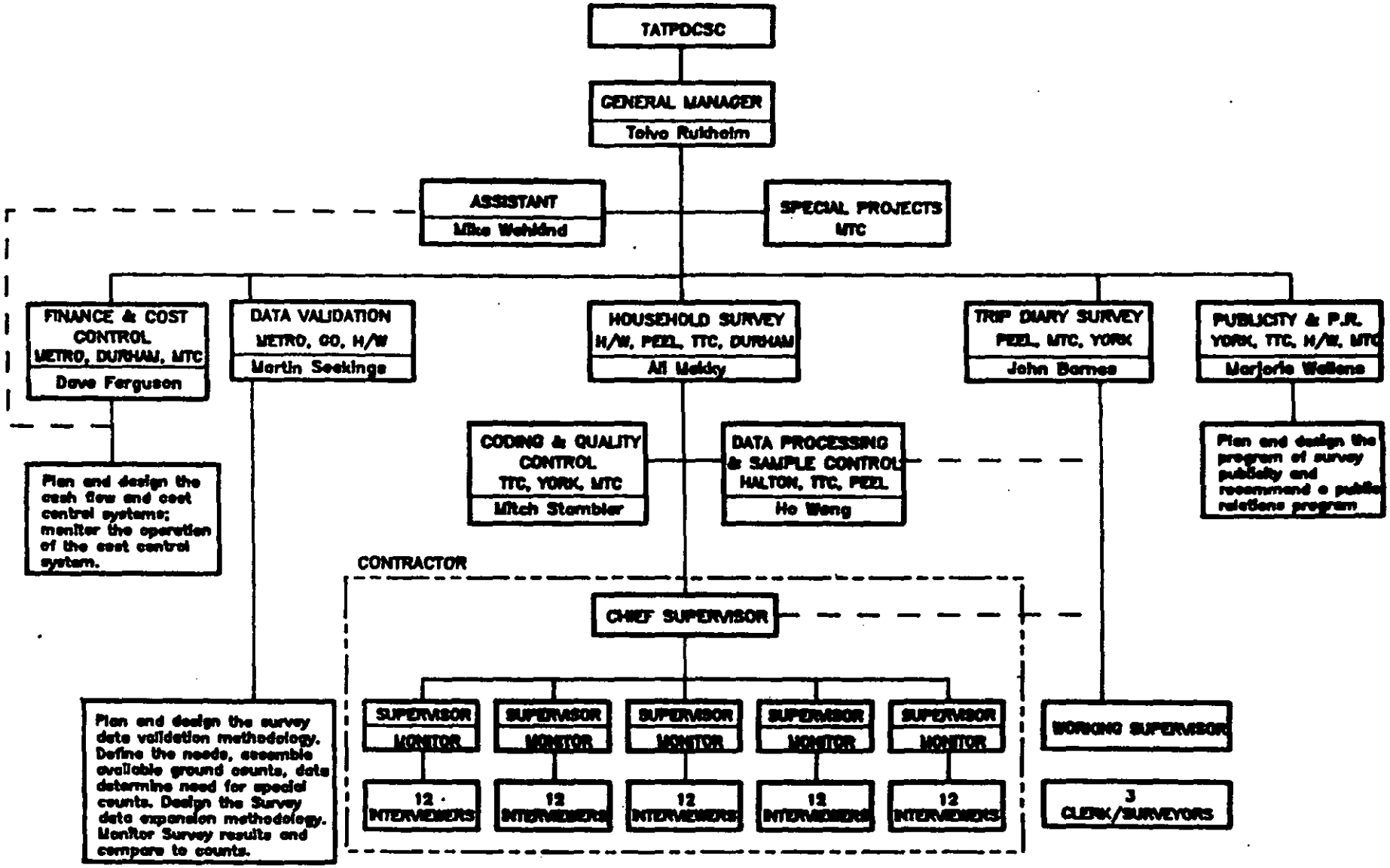

EXHIBIT 2

SUMMARY STATISTICS

Population of survey area	4,156,458
Target sample	4%
Original Sample	102,606 households
Ineligible+	7,866 "
No answer in 5 attempts	10,976 "
Total contacts	83,764 "
Completed interviews	61,502 (73% of contacts)
Number of persons surveyed	171,781 (4.1% of 1986 population)
Average household size	2.79 persons
Number of trips*	376,714
Average trips per person yrs.)	2.35 (excluding persons under 5 years)
Average vehicle ownership	1.42 /household (0.51/person)
Survey cost	$884,000
Cost per completed interview	$14.37
Completed interviews/hour/ interviewer	3.5

\+ Includes business numbers, phones not in service and letters returned because address unknown or moved.

* Excludes all trips by persons under five years of age and walk trips other than those to/from work and school.

EXHIBIT 3

INFORMATION COLLECTED

Household Information

- Dwelling Unit Type
- Number of persons
- Number of Vehicles

Personal information

- Age
- Sex
- Employment status
- Driver's licence (Yes or no)

Trip Information*

- Origin
- Destination
- Start time
- Purpose
- Mode of travel+

* A trip is defined as travel between one point and another for a single purpose. It may involve the use of one or more different modes.

\+ For trips made by public transit detailed information was collected on the routes used and transfer points.

EXHIBIT 4

COST BREAKDOWN

Management	$88,000
Field Work	480,000
Geocoding	250,000
Software development	40,000
Miscellaneous	26,000
	$884,000

Management	General Manager & Assistant
Field Work	Printing and mailing of advance letter Telephone interviews Initial data entry & verification Call backs
Geocoding	Computer rentals Geocoding staff Updating of address and monument files Error Correction (Includes $50,000 for temporary staff hired by the participating agencies to assist in the geocoding operation)
Software development	Adaptation of geocoding software (Includes $10,000 in agency contributions)
Miscellaneous	- Publicity - Office furniture - computer rental (Management system)

N.B. Agency costs are not included other than temporary geocoding staff and contribution to software development.

EXHIBIT 5

ADDITIONAL INFORMATION COLLECTED IN TRIP DIARY SURVEY

Employment Data (for 1 or 2 jobs)

- Work address
- Occupation
- Type of work establishment
- Hours by day of work
- Transit/auto availability
- Parking cost

School Data

- Full or part-time
- School address
- Hours by day of week
- Normal travel mode
- Transit availability

Personal Information

- Income

Annexe 3

THE TRANSPORTATION TOMORROW SURVEY

DESIGN AND CONDUCT OF THE SURVEY

FIRST REPORT OF A SERIES

Ontario

A survey conducted for:
the Regions of Durham, Halton, Hamilton-Wentworth, Peel and York;
Metropolitan Toronto, Ministry of Transportation,
GO Transit and the Toronto Transit Commission.

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based system used Statistics Canada Area Master Files to look up and assign unique XY coordinates to each address. While the coordinate systems (UTM) is capable of locating any point on earth to within one metre, the Area Master Files assign addresses to the centre of the respective blockface.

The geocoding software was developed with the capability of dealing with intersections and monuments (e.g. CN Tower) as well as detailed street addresses. The survey respondents reported their trip ends in the following proportions:

Detailed address	52%
Monuments	30%
Intersections	18%

The system had the ability to "learn" as monuments were added to the monument file and as alias names (e.g. common misspellings) were entered into the system. The success rate varied by the type of address:

Monuments	37%
Intersections	60%
Street Addresses (not a home address)	45%
Home Address	76%

5. SURVEY COSTS

For planning purposes the budget for the survey field work was set at $800,000 plus contributions of services, supplies, and manpower from the participating agencies. In addition to the above, the Ministry of Transportation and Communications also agreed to fund the total cost of a Pilot Survey.

The actual costs for the household telephone interview

TELEPHONE INTERVIEWING STATISTICS

*72 telephones in total were used to conduct the survey.

- 60 telephones in Toronto covering Toronto, Durham, York, and Peel
- 12 telephones in Hamilton covering Hamilton-Wentworth and Halton

*3.5 interviews completed by each interviewer each hour

*Up to 5 attempts made to contact each household

50.7% of interviews completed on 1st call
25.2% of interviews completed on 2nd call
12.2% of interviews completed on 3rd call
6.3% of interviews completed on 4th call
5.6% of interviews completed on 5th call

*Sample Usage

Total Sample Used	102,606
Refusal Rate	25.9%
Response Rate	73.7%
Completion Rate	60.1%

	No. of Completed Interviews(Households)	% of all Households
Metropolitan Toronto	34,398	4.0%
Peel	7,661	4.2%
Hamilton-Wentworth	6,549	4.1%
York	4,628	4.6%
Durham	4,388	4.1%
Halton	4,050	4.5%
Unknown/external	34	0.1%
TOTAL	**61,708**	**4.1%**

EXECUTIVE SUMMARY

1. INTRODUCTION AND BACKGROUND

The Transportation Tomorrow Survey was a major travel survey conducted from September until December 1986. It consisted of telephone interviews with over 61,000 households in Metropolitan Toronto and the Regional Municipalities of Hamilton-Wentworth, Halton, Peel, York, and Durham (see Exhibit 1.1, Study Area).

The project was undertaken and funded jointly by the Ontario Ministry of Transportation and Communications (together with GO Transit) and the six regional municipalities inside the study area. In Metropolitan Toronto, participation was split between the Metro Planning Department and the Toronto Transit Commission.

The last comprehensive area-wide travel survey in the Greater Toronto Area was conducted in 1964 (MTARTS Origin-Destination Survey - see Table 1.1). Since 1977, the major public agencies involved with transportation planning in the GTA have been meeting regularly as the Toronto Area Transportation Planning Data Collection Steering Committee (TATPDCSC) to coordinate data collection efforts. In 1985, the TATPDCSC began planning for a major survey to coincide with the mid-term Census in 1986.

2. PLANNING, DESIGNING, AND ORGANIZING THE SURVEY

The overall organization structure of the survey is shown in Exhibit 2.1. The structure reflects the cooperation and team work on the part of the nine transportation planning agencies in order to carry out the survey.

numbers) was purchased from Bell Canada (see Section 2.4.4). An advance letter signed by the Regional Chairman and the Minister of Transportation and Communications (see Exhibit 2.4) was mailed to all households prior to telephone contact.

Interviewing was conducted from Toronto (60 telephones) and Hamilton (12 telephones) with the Hamilton-Wentworth and Halton Regions being called from Hamilton while the rest of the study area was called from Toronto. Up to five attempts were made to reach a household; a busy signal did not count as an attempt and attempts had to be at least 2.5 hours apart.

The interviewer followed a set script (see Exhibit 2.2) but in order to allow a natural flow, interviewers were encouraged to use the script as a guide, not as a rigid formula. Calls were monitored on a random sample basis by supervisors and by members of the TATPDCSC. The interviewers recorded their responses on a coding form (see Exhibit 2.3) which, after being scheduled by a supervisor, was forwarded to data entry.

4. DATA ENTRY, CODING, AND EDITING

Data entry was accompanied by automated error checking (range checks and logic checks) with errors being referred back for correction (see Exhibit 4.1) for an overall flow chart of the process). Accepted records were forwarded to a team of TATPDCSC personnel for coding the addresses of all origins and destinations in the trip records.

Coding of address data was accomplished using a new automated process developed specifically for the Transportation Tomorrow Survey. The microcomputer

EVENTS IN THE CONDUCT OF THE SURVEY

1977	Formation of the Toronto Area Transportation Planning Data Collection Steering Committee
May 1985	Provincial approval in principle to fund survey
Sept.- Oct. 85	Approval in principle of commitment to the survey by Metro and six Regions
Aug. 85 - Jan. 86	Design of Pilot Survey; selection of contractor to carry out Pilot Survey
March 86	Pilot Survey telephone interviews
April 86	Appointment of Survey General Manager
April 86	Report on Pilot Survey. Review of findings
May-June 86	Contact made with potential contractors to conduct telephone interviewing for main survey.
June 86	National Census
June 27, 86	Contractor selected to conduct interviewing and data entry
Sept. 86	Press Conference held in each Region with Regional Chairman as key spokesman; Metro Toronto news conference with Metro Chairman and Minister of Transportation and Communications.
Sept. 16 - Dec. 13, 86	Telephone interviews with 61,708 households
Sept. 86 - Feb. 87	Data entry and error checking
Oct. 86 - April 87	Geocoding of origin/destination information and transit route data

The preparations for the survey were carried out through special subcommittees (teams) of the TATPDCSC Work Group. Each team was headed by a Team Coordinator who reported to the Main Work Group.

The Publicity and Public Relations Team designed and carried out the publicity program.

The Finance and Cost Control Team designed and oversaw the cost control systems.

The Data Validation Team assembled data and made preparations for the expansion and validation of the survey data.

The Household Survey Team designed and oversaw the conduct of the telephone survey.

The Coding and Quality Control Team designed part of the interviewer training program and management reports on productivity and quality.

The Data Processing and Sample Control Team designed the sample and the data processing system.

The Trip Diary Survey Team designed and oversaw the conduct of a separate more detailed mail-back survey.

3. TELEPHONE INTERVIEWING

The survey interviews were conducted by telephone between September 16 and December 13, 1986. Through a competitive bidding process, (see Section 2.5) a marketing research firm was retained to do the telephone interviewing along with data entry and related tasks.

A sample of households (names, addresses and telephone

FINANCIAL SUMMARY

Source of Funds

1.	Funded through cost sharing agreement	Province Regions	$627,000 200,000	$827,000
2.	Special funding from Province for Pilot Survey and Trip Diary			86,000
3.	Supplies, services, and man-power provided by partici-pating agencies			130,000
	TOTAL:			**$1,043,000**

Summary of Expenditures

1.	Administration	$88,000
2.	Pilot Survey	37,000
3.	Telephone Interviews	501,000
4.	Geocoding	301,000
5.	Other	65,000
6.	Trip Diary	51,000
	TOTAL:	**$1,043,000**

survey were $825,000, plus the supplies, services, and manpower provided by individual agencies estimated to be worth approximately $130,000. The Ministry of Transportation provided additional funding for the Pilot Survey ($37,000) and the Trip Diary Survey (approximately $50,000).

The telephone survey cost approximately $16 per completed household. These costs do not include subsequent costs for processing and analysing the data.

6. CONCLUSIONS AND RECOMMENDATIONS

Some of the conclusions and recommendations about the Survey must be considered preliminary or tentative because only in-depth analysis of the tabulations of the survey responses will show how well the survey process achieved its goals.

6.1 Telephone Surveys

Telephone interviews are a cost effective method of collecting household travel information, although the quality of response remains to be proven.

6.2 Sample

Bell's telephone listings appears to be a good source for drawing the sample for a travel survey. However, it is recommended that in future more emphasis be placed on the design and control of the sample.

6.3 Direct Data Entry

It is recommended that any future survey give serious consideration to using direct data entry. Furthermore, it is recommended that the direct data entry system consist of a full screen representation of the entire questionnaire with

full screen editing capabilities, as opposed to the CATI systems used by market research firms. The CATI approach, a page by page system, is tailored to the highly structured interviews common to marketing research surveys; this approach is unsuited to travel surveys where it is important for the interviewer to get an overall understanding of the household's activity pattern and to probe for trips which the respondent may have forgotten to mention.

6.4 Marketing Research Industry

It is recommended that future surveys not necessarily rely on the market research industry to carry out the field work. Equal consideration should be given to some of the other possibilities described in Section 6.6.

6.5 Quality of Telephone Interviewing Staff

The contractor had difficulty attracting enough capable interviewers to staff the 72 telephones. It is felt that the low interviewer wage rate affected the number and the quality of the people available to do the work.

It is recommended that an interviewer hourly wage rate be established at the outset when preparing for any future surveys. This rate would be paid to interviewers whether the survey is done in-house or by an outside contractor. This will require some research and analysis in the labour market place. The established rate should be significantly higher than the prevailing marketing research interviewer rates, possibly 50% higher.

6.6 Contract Out vs. In-House

Starting with the wage rate established as per

i) Use of monuments in describing trip ends.

ii) Use of well defined recording conventions for addresses, monuments and intersections.

iii) Most major telephone travel surveys have been content with making three attempts to contact each household. The Transportation Tomorrow Survey required five attempts; the fourth and fifth attempts were responsible for approximately 12% of the final total of completed interviews. The merits of retaining the fourth and fifth attempts in future surveys will need to be assessed from a detailed analysis of the data produced by these additional attempts. The initial reaction, however, would be to recommend retaining the five attempts, except if it can be shown that these attempts make no significant contribution to the quality of the final data base.

Annexe 4

THE TRANSPORTATION TOMORROW SURVEY

DATA VALIDATION

SECOND REPORT OF A SERIES

Ontario

A survey conducted for:
the Regions of Durham, Halton, Hamilton-Wentworth, Peel and York;
Metropolitan Toronto, Ministry of Transportation,
GO Transit and the Toronto Transit Commission.

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I. INTRODUCTION

Since November 1987, the Data Validation Team met on a regular basis to analyse and compare the Transportation Tomorrow Survey (TTS) data with other independent data sources such as Census Surveys and Cordon Count Programs. The team consisted of representatives from the Ministry of Transportation, Regional Municipalities within the Greater Toronto Area, the Toronto Transit Commission and GO Transit. The purpose of the data validation exercise was to determine the quality of the data base, identify any required corrections, and to provide guidance on the use of the TTS results.

This report summarizes the Data Validation Team's findings and comments. It is intended to be used as a technical reference source for future work on the TTS. It should be noted that the results presented here are based on Version 1.0 of the data base. A more detailed validation exercise is expected when an updated version of the data base is available. The user guide for Version 1.0 TTS data is attached in Appendix 1.

The validation exercise covered a wide range of topics. These include:

(1) Demographic characteristics,
(2) Trip productions,
(3) Respondent / Non-respondent[1] differences,
(4) Trip attractions,
(5) Screenline counts, and
(6) Transit assignments.

Major findings on these topics are summarized in the next chapter. Detailed discussions from individual agencies and referenced materials are provided in Appendices 3 to 9. The reader should refer to these appendices for a more detailed overview of the validation exercise.

Recommendations on the use of the data and further study needs are also included in the report.

[1] Throughout this report "non-respondent" refers to individuals whose trip making was reported by another member of the household.

(1) Demographic Characteristics (Appendix 3)

The comparison of TTS estimates on selected household and personal characteristics with Census results suggests that the TTS sample is generally representative of the Greater Toronto Area population.

(a) Household and Population Sizes:

The expansion[2] of the survey sample was done on the basis of the number of households in the GTA according to the 1986 Census figures. A comparison of average household size and percentage distribution of households by size at the Census Metropolitan Area level was found to be consistent with the Census data.

Although the expansion of the TTS data resulted in an underestimation of the population, a 2.2% difference at the GTA level, the distribution of the population by age matches closely with the Census data.

(b) Employment and Participation Rates:

Labour force participation rates[3] at the 46 zone level (Planning Districts) were compared to the 1981 Census. The TTS results indicated a somewhat higher than expected growth in participation rate, from 48.1% to 54.7% for the whole GTA. This is partially due to the undercounting of people not in the work force (e.g. institutions such as retirement homes, orphanages were not surveyed) by the TTS.

The estimate of the total number of workers living in Metro Toronto from TTS matches the 1986 Labour Force Survey (1,179,600 and 1,174,300 respectively). Due to differences in the definition of full and part time workers between TTS and other surveys, direct comparison of results is not possible.

[2] The sample expansion procedure is described in Appendix 2.

[3] Participation rate is defined as 'employed labour force' divided by 'total population'.

(2) Trip Productions (Appendix 4)

Comparison of expanded TTS trips by trip purpose, time period and by mode were made with other independent sources such as the 1979 Metro Toronto Travel Survey (MTTS), TTC ridership surveys and Cordon Count Programs.

(a) Work Trip:

Trips to work can be divided into three categories; 1. Home to work, 2. Work to work (i.e. business trips) and 3. Other to work. Average employment trip rate based on category 1 was 0.74 trip per employed person and the combination of category 1 and 3 gives a figure of 0.83. The true rate for trips from home to work, taking account of intermediate stops for other purposes, is expected to be somewhere in between the two estimates.

(b) Cordon Count Comparisons:

In comparison to an interpolation between the 1985 and 1987 Cordon Count results, TTS a.m. (7-9) peak trips were found to match closely with the actual reported trips at the Metro boundaries, both inbound and outbound. However, a similar comparison for the 12-hour (7 a.m. - 7 p.m.), two-way travels shows a significant under-reporting of trips, approximately by 36%. The extent of this under-reporting appears to be comparable for both auto and transit modes. This suggests that there is a large number of off-peak trips that were unreported to the TTS.

(c) Trips by Purpose and Mode:

When looking at the daily (24 hour) percentage shares of reported trips by mode and purpose, the TTS results appear to be consistent with the results from other surveys. For example, both the 1986 TTC Attitude Survey and the MTTS give similar breakdowns of Metro transit trips by purpose as the TTS (75% for work and school and 25% for others). However, the estimates for the total number of vehicular and transit trips do appear to be low.

Overall, TTS is under-reporting transit trips by approximately 20% with greater under-reporting for TTC streetcar routes, GO Bus services and Vaughan Transit services.

(3) Respondent / Non-Respondent Differences (Appendix 5)

There is a substantial difference in the number of trips per capita in the sample population between individuals that were reporting their own trips (respondents) and those whose trips were reported by someone else in the household (non-respondents), 2.54 versus 1.65. The difference in trip rates is no doubt partly due to the respondent having incomplete knowledge of trips made by other members of the household. However, characteristic differences between the two groups could also explain some of the variation.

(a) Attribute Differences

Single person households are expected to have higher per capita trip rates because trips normally shared by members of the household (e.g. shopping trips) must be now made by the same person. Approximately 20% of respondents were in single person households.

Persons with high mobilities also tend to have high trip rates. About 80% of the respondents possessed a valid drivers licence whereas only 50% of the non-respondents were eligible to drive.

A high proportion of non-respondents were children and teenagers whose trip characteristics are significantly different from adults.

(b) Trip Rates by Purpose, Sex, and Mode:

There was considerable variation of trips by purpose observed between respondents and non-respondents among both males and females. The largest difference appears in the ratio of "facilitating" trips between female respondents and non-respondents (3.25 : 1.0).

Trip rates for female respondents were consistently higher than that of males except for work related trips. However, for non-respondents, female trip rates were conversely lower than that of males except for shopping and personal business trips.

Males are more likely to travel by driving than females for both respondents (80% vs. 60%) and non-respondents (55% vs. 35%).

Trip rates per employed person for work purpose has the second smallest difference between respondents and non-respondents ("others" being first) for both full time (1.0 vs. 0.87) and part time (0.56 vs. 0.49) workers.

The above analysis confirms that non-work trips made by non-respondents tend to be under-reported in relation to those made by respondents. This agrees with the observations that TTS-reported trips are low on off-peak travel and on trip rates for people not in the labour force.

(4) Trip Attractions (Appendix 6, 9)

An examination at TARMS zone level was carried out to check that trip destination by purpose matches the location of major trip generators. This also acts as a preliminary check on the geocoding of major shopping malls, educational institutions and business centres.

(a) Work Trips:

Comparisons of TTS 24-hour work trip estimates and employment data from Metro Toronto and York Region were made. On the whole, the comparisons indicated an acceptable degree of agreement among the data. The exercise revealed some miscoding of work locations, however, these coding errors do not affect the global picture on work travel.

(b) School Trips:

TTS school trips were compared with school enrollments for the Regional Municipalities of Durham and York. The percent distribution of school trips for each TARMS zone was good, but there were significant differences between the actual enrollments and TTS reported trips. For example, the difference between TTS trip data and both York and Durham Region enrollments on an absolute number basis is approximately 20%. This is similar to the observed difference between TTS reported work trips and total employment figures. The 20% difference is likely to account for school absentees due to illness, school and public vacation days.

(c) Shopping Trips:

TTS shopping trips were compared with gross floor area of selected major shopping centres. Generally there seems to be a consistent relationship between reported shopping trips and shopping centre size. For example, major regional centres such as Yorkdale, Sherway Gardens, Scarborough City Centre and Square One all attract approximately 12,000 to 13,000 shopping trips on an average weekday.

No obvious spatial bias was found on trip attractions by purpose. The next validation step is to check for consistency of trip rates by purpose and destination. A fair number of geocoding errors were found with the monument codings, however, these errors do not pose a major concern at the aggregrate level. These errors will be corrected in future versions of the data base.

(5) **Screenline Counts** (Appendix 7, 9)

A 26 zone system was developed for a comparison of TTS trip data with Regional Cordon Count Programs. The zoning is based on locations of major screenlines. The general observations for Metro Toronto are:

- 12 hour (7:00 a.m. to 7:00 p.m.) total TTS trips fall short of boundary volumes by approximately 35-40%. This underestimation is consistent for both inbound and outbound travel at all three boundaries.
- Peak period TTS flows are generally much closer to the counts (especially for AM peak), more for transit than for auto trips.

The findings here agree with earlier conclusions. Peak period travel (mainly work and school trips) is much more accurately reported. Under-reporting of daily trips occurs mainly in off-peak trips (combination of discretionary and non-home based trips). For the Regional Municipality of York, TTS data during the midday period account for only half of all vehicular trips reported by the Cordon Count Program.

One reason for the low number of TTS reported trips is the aforementioned problem of the poor reporting of non-respondent off-peak trips. The zone system trip assignment comparison was also an extremely coarse approach. Many trips have to cross more than one boundary line due to the arterial and highway network configuration, but are only counted once by the zonal assignment method. Furthermore, without a network assignment, TTS trips were assigned manually through boundaries which in reality may not be the true travel routes.

Other plausible sources for the variation are trips excluded from the survey (e.g. taxi and delivery trips), through trips to and from outside of the GTA (e.g. trucks), and people living outside the surveyed area but employed within the GTA.

(6) Transit Assignments (Appendix 8)

A comparison was made between reported TTS trips assigned by MADITUC (a transit network assignment program) to TTC surface routes and TTC riding count data for the same period of the survey.

Generally AM peak period ridership on TTC surface routes appears to be within twenty percent (20%) of the observed ridership. Greatest accuracy is achieved on major routes serving suburban corridors. Minor service routes which overlap major routes have the greatest under-reporting. This is probably due to mis-reporting or mis-coding of trips using minor transit routes to major transit routes.

Incomplete routing information (e.g. missing access / egress modes or short transfers between major routes) is expected to be another major source for the low transit ridership estimates. This is because those under-reported minor service routes also tend to be short, low ridership routes. Furthermore, MADITUC only assigned trips which have a reasonable routing sequence between points of origin and destination. This in turn resulted in the loss of 5% to 10% of reported TTS transit trips prior to the trip assignments.

III. CONCLUSIONS

While there are small discrepancies between TTS data and other sources of demographic data there is no indication of obvious bias or deficiency in the data. The TTS data appears to provide a good representive sample of GTA trip makers.

Looking at peak period travel, TTS provides a good record of both transit and auto trips. The comparisons of TTS peak period transit trips with TTC ridership counts and TTS auto trips with Cordon Count figures show that there is no significant indication of under-reporting. However, there is a substantial under-reporting of trips on a daily basis. This suggests that there are a large number of off-peak trips unreported to the TTS. Two other observations were found to support this suggestion.

First, home-based work and school trips make up the bulk of peak period trips (especially for the AM peak). These were found to be the most accurately reported trips.

Second, for all age groups, the trip rates for non-work and non-school trips were significantly different between the respondent and non-respondent population. This is especially true for persons who are not in the labour force.

It appears that the under-reported trips are mainly discretionary trips, such as shopping and social-recreational trips, and non-home-based trips. Findings to date indicate that the under-reporting is more severe for non-respondents than respondents.

Given the consistency of TTS results and other independent estimates on both auto and transit peak period travel, and the accurate reporting of home-based work and school trips, the TTS data can be used with reasonable confidence for peak period transportation planning.

IV. RECOMMENDATIONS

(1) Data Correction :

To finalize the TTS data base, a detailed examination of monument geocodes is essential. Monuments assigned to incorrect locations must be identified, corrected, and incorporated into future versions of the data base.

(2) Further Study Needs :

The validation exercise revealed several areas where further studies are needed. Two of these areas where immediate action is needed are:

(i) Screenline Comparisons

To provide a more realistic comparison between TTS trip estimates and Cordon Count figures,

1. Auto trips should be assigned onto a network system.

2. Prior to another transit trip assignment, such as one using MADITUC, transit route codes, transfer points (between transit routes and between private and public modes) etc. should be checked.

(ii) Under-Reporting of Trips

A significant difference between respondents and non-respondent trip rates contributed to a gross under-estimation of off-peak trips. An adjustment method is required to account for this under-reporting.

(3) Use of the Data Base :

The data base is good, reliable and can be used as is for peak period transportation planning. However, it should be used with caution for detailed O-D analyses such as those at the TARMS traffic zone level and for off-peak analysis. This is due to the fine disaggregate level of the TARMS system and not because of any sampling error in the TTS. Adjustments for the under-reporting of off-peak trips are recommended.

Annexe 5

THE TRANSPORTATION TOMORROW SURVEY

VERSION 2.2
DATA GUIDE

THIRD REPORT OF A SERIES

Ontario

A survey conducted for:
the Regions of Durham, Halton, Hamilton-Wentworth, Peel and York;
Metropolitan Toronto, Ministry of Transportation,
GO Transit and the Toronto Transit Commission.

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Annexe 6

THE TRANSPORTATION TOMORROW SURVEY

AN OVERVIEW OF TRAVEL CHARACTERISTICS IN THE GREATER TORONTO AREA

FOURTH REPORT OF A SERIES

Ontario

A survey conducted for:
the Regions of Durham, Halton, Hamilton-Wentworth, Peel and York;
Metropolitan Toronto, Ministry of Transportation,
GO Transit and the Toronto Transit Commission.

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1.0 INTRODUCTION

Travel characteristics at an inter-regional level can best be determined by conducting an origin-destination travel survey. In 1986, members of the Toronto Area Transportation Planning Data Collection Steering Committee carried out such an initiative for the Greater Toronto Area called the Transportation Tomorrow Survey. This is the most comprehensive survey of travel patterns carried out in the Toronto area since a home interview survey was carried out in 1964 as part of the Metropolitan Toronto and Region Transportation Study (MTARTS). It is expected that the results of the 1986 survey will be used for transportation planning and analysis for a number of years into the future.

This report is meant as a preliminary overview of the key findings of the survey. Where possible it contains comparisons with the results of previous surveys of travel characteristics within the six Regions of the Greater Toronto Area.

2.0 SUMMARY

The Transportation Tomorrow Survey has indicated that a substantial increase has occurred in trip-making - it measured 8.7 million trips a day generated by residents in the Greater Toronto Area in 1986. This compares with approximately 3.7 million trips measured in 1964 by the MTARTS survey.

Trip-making has been growing at a rate considerably faster than the population growth of the area. While population has grown at an average of 1.9% per year over the past 22 years, trip-making has grown at 3.9% per year over the same period. In 1986, on the average, 2.1 trips per day were made by each person. The corresponding trip rate was 1.3 trips per person per day in 1964.

Overall trip rates are higher in the outlying Regions (ranging from 2.2. to 2.5) than they are in Metro Toronto where the trip rate is 2.0 trips per person per day.

A number of factors have helped to bring about a higher rate of trip-making. Households have become smaller (declining to 2.8 persons/household), resulting in more concentration

of trip-making activity. A prosperous economy has created new jobs, many of which have been filled by women who have entered the labour force in increasing numbers. Female participation in the labour force increased by 50 percent between 1971 and 1986, at which point it was 77 percent of the rate for males. The population has aged in such a way that the proportion of people of working age (16 to 65 years) has grown. The expanded labour force has created more demand for transportation. Auto ownership per person has doubled since 1964, a reflection of increasing affluence of the area and of a trend towards suburban auto-oriented development.

Eighty-three percent of the daily personal travel that occurs takes place within Regional boundaries. The remaining 17 percent of the travel crosses Regional boundaries. Almost two thirds of all trips have Metro Toronto as either the origin, the destination or both. Nearly half of all GTA trips take place entirely within Metro Toronto. The Regions of Peel and York have the highest trip interaction with Metro Toronto. Approximately one third of the trips by York Region residents and over one fifth of the Peel trips cross into Metro Toronto. The degree of self-containment, in terms of the proportion of

work trips that stay within Regional boundaries, is highest for Metro Toronto (87%) and for Hamilton-Wentworth (85%).

In comparing the TTS results with the earlier MTARTS survey, trip purpose has shifted very little. The dominant purposes continue to be work and school, but there has been a small increase in non-home based trips, reflecting a change in lifestyle.

Transit ridership in the GTA has been growing at a faster rate than population due primarily to the increased popularity of the services provided by the Toronto Transit Commission and GO Transit. The transit share of trip-making for all purposes combined has increased in each Region. Metro Toronto has the highest 1986 transit modal split at 25.7%. Transit modal splits for work trips to Metro Toronto have increased since 1979. Current transit modal splits for home to work trips by residents of a Region are 7 to 8 percent for Durham and Halton, 10 to 12 percent for York, Hamilton-Wentworth and Peel, and 33% for Metro Toronto.

Age and sex are both key factors in the propensity to make trips. Women, on average, are one third more likely to use transit as men, and they are one third less likely to drive

on a given day. The heaviest users of transit are teenagers and they are twice as likely to make transit trips (school bus or public transit) as are people of age 30 or older. The auto driver trip rate per person peaks strongly at about age 40 and declines rapidly as age increases. These relationships are very important factors which can be expected to affect future trip-making activity in the Greater Toronto Area in the light of changing age profiles.

The Transportation Tomorrow Survey indicates that trip-making start times peak sharply in the morning. A broader peak occurs in the afternoon and evening. There has been relatively little change in this start time distribution over the past 30 years.

Work trips and transit-based trips are the strongest contributors to the peaks which occur during the day.

The 1986 Transportation Tomorrow Survey provides a comprehensive record of daily travel throughout the Greater Toronto Area by residents. It will provide, on an ongoing basis, an improved understanding of current travel patterns and behaviour which is essential for determining future transportation requirements.

Annexe 7

THE TRANSPORTATION TOMORROW SURVEY

TRAVEL SURVEY SUMMARY FOR THE GREATER TORONTO AREA

FIFTH REPORT OF A SERIES

UNIVERSITY OF TORONTO / YORK UNIVERSITY
JOINT PROGRAM IN TRANSPORTATION
DATA MANAGEMENT GROUP

TRAVEL SURVEY SUMMARY FOR THE GREATER TORONTO AREA

Prepared for the

Toronto Area Transportation Planning
Data Collection Steering Committee

by the

Data Management Group,
University of Toronto / York University
Joint Program in Transportation
June 1989

Participating Agencies:

GO Transit
Metropolitan Toronto
Ministry of Transportation, Ontario
Regional Municipalities of Durham, Halton, Hamilton-Wentworth,
Peel and York
Toronto Transit Commission

ACKNOWLEDGEMENTS

This report was prepared by the **University of Toronto / York University Joint Program in Transportation Data Management Group (DMG)** for the **Toronto Area Transportation Planning Data Collection Steering Committee** under the direction of the ITS technical committee, the **Transportation Research and Data Management Group (TRADMAG)**. The activities of the DMG have been funded by a grant from the **Ministry of Transportation, Ontario**. The members of the **Steering Committee**, and consequently **TRADMAG**, represent the agencies listed below, and are involved with transportation planning within the Greater Toronto Area. The contributions of these members to the production of this report and to the ongoing work of the DMG is gratefully acknowledged.

Ministry of Transportation, Ontario
Municipality of Metropolitan Toronto
Regional Municipality of Durham
Regional Municipality of Halton
Regional Municipality of Hamilton-Wentworth
Regional Municipality of Peel
Regional Municipality of York
Toronto Transit Commission
GO Transit

FURTHER INFORMATION

The Transportation Tomorrow Survey was a comprehensive telephone interview survey on household travel behaviour in the Greater Toronto Area conducted in the fall of 1986 by the **Ministry of Transportation, Ontario** under the direction of the **Toronto Area Transportation Planning Data Collection Steering Committee**. The data is currently under the care of the **Data Management Group** at the University of Toronto. This group is responsible for making available detailed travel information from the TTS data base. Requests for information from the TTS, or enquiries related to the contents of this report should be directed to the address below. Additional copies of this report may also be obtained from this source at a cost of thirty dollars per copy.

Data Management Group,
University of Toronto / York University
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INTRODUCTION

BACKGROUND

Transportation is essentially a public service and transportation planning is concerned with the proper allocation of public funds to activities related to this service. Proper planning can encourage investment that provides a high level of transportation service to commuters and acts as a catalyst to land and economic development.

The demand for urban transportation is driven by the location of urban activities. The magnitude and location of these activities in the Greater Toronto Area (GTA) have been experiencing dramatic change for several decades. Although the City of Toronto continues to be a large employment centre, growth in both employment and residential activities is occurring further and further from the central area. This trend places severe pressure on transportation facilities that are used to support the resulting increase in magnitude and length of trips in the GTA. Improvements to the existing transportation structure that are dictated by these changes require a planning process that evaluates all potential improvements.

Understanding the character and magnitude of today's urban travel is fundamental to proper planning for the future. The Transportation Tomorrow Survey (TTS) is an effort to provide a better understanding of personal travel activities across the GTA. It is the most comprehensive travel survey in the Toronto Area since the 1964 Home Interview Survey for the Metropolitan Toronto and Region Transportation Study (MTARTS).

The results from the Transportation Tomorrow Survey are a valuable source for all transportation planning activities. This report attempts to present in summary form the information contained in TTS, which should provide the reader with some appreciation of the data base. In addition, this report is intended to promote the use of the data base by any and all agencies associated with transportation in the Greater Toronto Area.

PURPOSE OF THIS REPORT

The TTS data is a large and complex collection of information on dwelling units, people and travel in the 6 Regional Municipalities of the Greater Toronto Area. Based on a random sample of households in the GTA, it contains detailed information for over 61,700 households. This data represents the demographic characteristics of approximately 1.5 million households, and the travel characteristics of 8.8 million daily trips made in the GTA.

The purpose of this report is to summarize the data according to commonly used geographic boundaries. The summary tables are in three levels of detail, namely, the entire Greater Toronto Area, each of the 6 Regional Municipalities and their respective Planning Districts. The report covers both socio-economic and travel characteristics. In addition to presenting the magnitude of the trips coming into and leaving an area, the summary tables and figures also describe travel characteristics such as travel purpose, start time, travel distance and travel mode choices.

For a global overview of GTA travel and comparisons of TTS with previous surveys, the reader may refer to TTS Report #4, An Overview of Travel Characteristics in the Greater Toronto Area.

THE TTS DATA

DESIGN AND CONDUCT OF THE SURVEY

The Transportation Tomorrow Survey (TTS) was conducted in the Fall of 1986. The survey covered the entire Greater Toronto Area (GTA). This area consists of Metropolitan Toronto and the Regional Municipalities of Durham, York, Peel, Halton and Hamilton-Wentworth.

The random sample of households in the study area was selected from Bell Canada's residential billing files. The Bell files contain the names, addresses and telephone numbers of households whose telephone numbers are listed in the telephone directory. Households with unlisted telephones were found to be uniformly distributed throughout the Study Area with no obvious correlation with socio-economic status. The target was a 5 percent complete sample across the study area. The actual sampling rate in each Forward Sortation Area (geographically defined by postal codes) was reviewed to ensure uniform sampling across the Regions.

An advance letter was mailed to all sample households prior to the actual interviews. The purpose was to introduce the survey, outline the survey process, and to impress on the household the legitimacy and importance of the interview.

The information collected by the telephone interviewers was manually recorded on coding forms and then entered into a computerized data base. Geographical referencing or "geocoding" was then used to record the sample households' addresses and locations of trip origins and destinations.

TTS Report #1, Design and Conduct of the Survey, provides detailed documentation on the planning and implementation of the survey.

INFORMATION COLLECTED

Both demographic and travel information were collected by TTS.

Demographic information:

1. Household characteristics
   a. Dwelling unit type
   b. Number of persons in household
   c. Number of available vehicles
2. Personal characteristics
   a. Age
   b. Sex
   c. Employment status
   d. Possession of drivers licence

Travel information:

1. Nature of trip
   a. Start time
   b. Purpose of trip
   c. Origin and Destination point
2. Means of travel
   a. Travel mode
   b. Detailed transit routings

A trip was defined as a one-way movement between two places for a single purpose. Trip information was collected for all persons 6 years of age or older over a 24-hour period. To reflect travel activities on an average work day, only trips made on Monday to Friday were recorded. The survey results indicated an equal coverage of trips on each of the five weekdays. A walk or bicycle trip was recorded only if it was made between home and work or home and school.

SAMPLE EXPANSION METHOD

A total of just over 61,700 households were successfully interviewed during the survey. Based on the 1986 Census count of about 1,470,000 households in the Greater Toronto Area, this constitutes a 4.2 percent sample of all households. As intended, the distribution of completed interviews among the Regions was very close to their distribution of household shares in the GTA.

A set of expansion factors was used to expand the information contained in the completed surveys to represent that of the total population in the GTA. These factors were defined as the ratio of the number of Census household units to the number of surveyed household units in an "aggregation district". There were 191 aggregation districts defined for the Study Area. To ensure spatial consistency of the expansion factors, each aggregation district was defined so as to contain a minimum of 2,500 Census household units.

TTS Report #3, Version 2.2 Data Guide, provides a comprehensive description on the sample expansion procedure for the TTS data base. It also provides details of the structure of the data base.

QUALITY OF THE TTS DATA BASE

A Data Validation Team was organized to perform a series of validation exercises on the TTS data base. The purpose was to determine the quality of the data base and to identify any corrections that may be necessary. This validation exercise is fully documented in TTS Report #2, Data Validation. Data entry errors discovered by performing range and logic checks have been corrected and implemented into the current TTS data base, Version 2.2.

The validation exercise indicated that the TTS data base is reliable and representative. With respect to peak period trips, there are no significant differences between TTS results and other data sources such as Census, Labour Force Surveys and Cordon Count Programs. Therefore, the TTS results can be used with reasonable confidence in transportation planning analyses that relate to peak period travel.

As noted in the Data Validation report, a discrepancy has been noted stemming from the tendency of households to remember less about, and to therefore under-report off-peak trips. The effect of this on the accuracy of the TTS's off-peak trip reports is currently being verified.

REPORT CONTENTS

OVERVIEW

The data in this report are presented in two sections. The first section contains demographic characteristics and travel patterns for spatially disaggregate zones. The zones are defined according to Major Planning Districts in addition to summaries according to Regional Municipalities. The second section contains Origin-Destination matrices at the 46 Major Planning District and 6 Region levels.

It must be emphasized that the data in this report consist of **estimated** values derived from Version 2.2 of the TTS data base. The TTS data base is a sample of about 4.2 percent of the households in the GTA. In order to produce the results presented here, the sample was expanded as documented in TTS Report #3 Version 2.2 Data Guide on the basis of the number of **households** sampled. In the sense that it has been factored up from a representative sample, this data base differs in origin from comprehensive data sources such as the Census.

The next section describes the general assumptions used in preparing the data for this report. The following sections discuss in more detail the basis of certain of the figures reported as demographic characteristics and travel patterns. In the data descriptions an **expanded total** refers to the expansion of an observed total by the appropriate household expansion factors.

GENERAL

Several assumptions are used in the preparation of this report which apply to all of the data presented. First of all, to reflect the fact that the numbers presented have been expanded by factors averaging about 25, all totals and subtotals are rounded to the nearest hundred. In addition, all percentages are rounded to the nearest integer.

The second assumption has to do with the handling of invalid survey responses. These are dealt with in two ways. The response is grouped under the "other" category if one is available (dwelling type, for example). Otherwise, the invalid responses are distributed proportionately between the available categories.

The third assumption has to do with external trips. The GTA is subdivided into 46 planning districts. The intent of the TTS was to document travel behaviour within this area. Included in the data base are a certain number of trip records that refer to trips originating in the GTA and linked to destinations external to the GTA. However, due to the home-based sampling technique used, there is no information about trips destined to the GTA from external households. In this report, externally destined trips are included in the **Travel Patterns** data in the first section. In the second section of **Origin-Destination Matrices**, however, these trips are excluded since the intent is to provide a sense of the spatial orientation of GTA trips. Such an orientation would not benefit from the inclusion of an aggregated "External Trips" category, especially so since these trips are not completely accounted for.

DEMOGRAPHIC CHARACTERISTICS

The two figures **Total Number of Households** and **Total Population** are simply the observed totals of household and person records in the data base expanded as discussed above. The **Persons per Household** figure results from the division of the two figures.

The three statistics **Employees per Household**, **Drivers per Household**, and **Vehicles per Household** are the expanded total numbers of employees (full time and part time), licensed persons, and vehicles respectively divided by the number of households.

The **Employment Status** categories exclude **Work at Home** data. Although these data were collected, the number of people involved was found to be insignificant. The **Part Time** category includes all students with part time jobs. The **Student** category includes only full time students who are not employed in any way.

The **Average Age** statistic comes from adding the ages of the expanded group of all individuals, and dividing by the expanded total population.

TRAVEL PATTERNS

The travel patterns in each area of interest are summarized in two ways. The first includes all trips for which the tripmaker's place of residence is within the area of interest. The trips accounted for in this way include trips made between origins and destinations both inside and outside of the area. The second summary is of all trips made that end in the area of interest. This group includes trips made by both residents and non-residents of the area.

The time periods dealt with are the 24 hour period, and an AM peak period of three hours. The AM peak period was chosen so as to minimize the number of non-work trips that were included. In general, trips made in the AM peak more often clearly

reflect primarily work oriented trips. Although the period chosen for the AM peak is indicated as being 6 to 9 AM, the data actually included in this period are for trips which started in the period from 6:00 AM to 8:59 AM. The reason for excluding trips starting at exactly 9:00 was that respondents tend to round off the times they reported to the nearest quarter or half hour. If data for 9:00 were included they would misrepresent the number of trips included in the peak period (that is, trips that were actually underway before 9:00).

The **Destination Trip Purpose** and the **Travel Mode** categories shown here are aggregated from the detailed information obtainable from the survey results. The **Trip Purpose** data represent all trips that have as their destination purpose either **Work**, **School**, **Shop**, **Home** or **Other**. The **Work** category includes both primary (first) and subsequent work trips made throughout the day. The **Other** category includes all other choices collected, namely **Personal Business**, **Entertainment / Social / Recreational**, **Passenger Pick Up / Drop Off**, and **Other**.

The **Travel Mode** categories shown are **Automobile** which includes auto drivers and passengers, **Transit** which includes any form of bus or rail transit including schoolbus, **Walk / Cycle** which includes walking and bicycling, and **Other**. The latter category includes **Motorcycles**, **Taxis**, and **Other**.

The trip lengths used to calculate the **Average Trip Length** were calculated as straight line distances between the points of origin and destination of the trip. The lengths were expanded and summed, and then divided by the expanded total number of trips. Trips with invalid entries for one or both end points were excluded from this calculation.

The **Daily Trips per Person** figure reflects the expanded total number of trips made by residents of the area over a 24 hour period, divided by the expanded total population. **The Daily Work Trips per Employed Person** reflects the expanded total number of primary (first) work trips made by full and part time employed persons.

ORIGIN-DESTINATION MATRICES

The Origin-Destination matrices include in this report cover the two time periods discussed above, and two trip purposes. **The All** trip purpose includes all valid trip records in the data base for which the origin and destination of the trip lie within the GTA.

The **Work** purpose includes the subset of the above records for which the destination purpose code in the data base indicates that the trip was the person's primary (first) work trip of the day. The zone of origin for the work trips is assumed to be the zone of residence of the person making the trip.

Note that all zero value cells in the matrices are shown as blanks to allow the table to be read more clearly. Since all of the numbers in these tables are rounded to the nearest hundred trips, an empty cell indicates that the expanded number of trips was less than 50.

Annexe 8

TABLE OF CONTENTS

THE TRANSPORTATION TOMORROW SURVEY

TRIP DIARY SURVEY ANALYSIS

SIXTH REPORT OF A SERIES

Ontario

A survey conducted for:
the Regions of Durham, Halton, Hamilton-Wentworth, Peel and York;
Metropolitan Toronto, Ministry of Transportation,
GO Transit and the Toronto Transit Commission.

1.0 INTRODUCTION

1.1 Trip Diary Survey

The Trip Diary Survey (TDS) used a mail-out, mail-back, self-administered questionnaire to collect socio-demographic and travel behaviour information for a stratified sample of Greater Toronto Area (GTA) households. TDS respondents were asked to provide personal socio-demographic data along with a record of all their travel during the 24-hour period for a preselected weekday. This information was collected for 15 weekdays between February 19, 1987 and March 11, 1987. The TDS survey form is presented in Appendix A, along with a brief history of the TDS Survey.

The TDS sample was selected from those households that had responded to the Transportation Tomorrow Survey (TTS), a travel habits survey of 61,000 GTA households carried out between September and December, 1986, using telephone interviews.

The Trip Diary Survey had three main objectives:

1. To provide data which could be used to validate TTS trip generation estimates.

2. To provide additional socio-economic and travel characteristics data for the Greater Toronto Area (GTA) that could not be collected in the TTS.

3. To provide information which would allow the MTO to assess the effectiveness of mail-back and telephone survey techniques.

Tranplan Associates was engaged by the Ministry of Transportation, Ontario (MTO) to undertake the Trip Diary Survey Analysis project in March 1989. This project was to provide the Ministry with a "clean" TDS data file, to validate both the TTS and TDS data, and to assess the effectiveness of mail-back and telephone survey methods.

1.2 This Report

This final report of the Trip Diary Survey project documents the TDS study process, describes the clean Trip Diary Survey (TDS) data file, and assesses the strengths and weaknesses of the data in relation to the original objectives of the survey. The report documents the validation of TTS telephone survey results, based on the analysis of the Trip Diary, evaluates the "Trip Diary" and Telephone survey methods, and presents recommendations for the design of future GTA transportation surveys.

The report in organized as follows:

Chapter 2, Exective Summary, outlines the study process and presents the detailed findings and conclusions discussed in Chapters 4 to 7;

Chapter 3 describes the TDS data files and Trip Diary Analysis Study process;

Chapter 4 documents the TTS validation exercise, which assessed Transportation Tomorrow Survey travel characteristics based on the comparison of matched TDS/TTS persons;

Chapter 5 describes the TDS validation exercise, which compared TDS-based estimates of demographic, socio-economic and travel characteristics with independent estimates in order to assess the validity of the trip diary data, and considered sampling and non-sampling errors (i.e., non-response bias);

Chapter 6 considers the potential research and planning applications of the TDS data base and presents various special tabulations of the trip diary data; and

Chapter 7, "Lessons for Future GTA Travel Surveys", assesses the applicability of both telephone and mail-back "diary" surveys and what changes should be considered in the design of future GTA travel surveys.

2.0 EXECUTIVE SUMMARY

2.1 INTRODUCTION

The Executive Summary provides an overview of the study process (Chapter 3) and summarizes the findings and conclusions of chapters 4 through 7.

2.2 TRIP DIARY SURVEY ANALYSIS PROCESS

Data Clean-Up Process

The clean-up process corrected data entry and logical errors found in TDS Household, Person and Trip files provided by MTO. A series of range and logic checks were used to identify invalid personal and trip information which were then corrected by referring back to the original TDS survey forms. The clean-up process added a total of 236 households to the TDS household file.

The TDS Version 1.0 data base contains 2,868 household records, 6,500 person records and 17,301 trip records.

Matching of TDS and TTS Person Records

In comparing TDS and TTS household and Person records, it was found that a total of 640 persons were missing in the TDS Version 1.0 person and trip files due to non-response. Estimates of GTA household characteristics based on the Version 1.0 data base would be inaccurate. In order to overcome this problem and to validate TTS trip generation estimates, it was necessary to develop a special data base containing only complete and matched households and related person and trip records.

The TDS matched and complete subset, TDS Version 1.1, contains data for 1948 households. This data base was developed using restrictive matching criteria (exact match on sex and age within 4 years). Appendix B documents the procedures and assumptions employed in matching TDS and TTS person records.

Development of Sample Weights

The TDS employed a stratified sample design. From a total sample of 6,010 households, 1,948 matched and complete TDS households distributed over 96 strata or cells, were selected for inclusion in TDS Version 1.1. The cell-specific weights were developed for the Version 1.1 data base by dividing the estimated number of households per strata by the number of valid returns in each strata.

2.3 TTS VALIDATION

An important purpose of the TDS survey was to provide information which could be used to validate the larger TTS telephone survey. The trip diary format, which allowed respondents to report their own travel behaviour, was expected to provide more accurate data on trip making than the telephone survey, which relied on one member of a household to report on the travel behaviour of all residents. Chapter 4 documents the TTS validation exercise which compared travel behaviour for matched TTS and TDS persons. The major findings of the TTS validation are presented in the following sections.

Home-Based Work Travel

TTS and TDS reported trip rates are within 1%, overall for full-time employees, with TTS results being marginally higher (1.52 vs. 1.51) and only minimal differences between TTS respondents and non-respondents (Exhibit 4.1).

Home-Based School Travel

The TDS diary survey reported 1.84 home-based school trips per day per full-time student whereas the same persons reponding to the TTS reported 1.74 trips per day (see Exhibit 4.2). While TTS and TDS estimates of school trip rates are within 5% of each other, TTS respondents reported more trips in the telephone survey than in the TDS trip diary survey, probably because of seasonal factors. TTS non-respondents reported marginally higher trip rates in the TDS survey, apparently because they included mid-day lunch trips, which were not reported in the TTS survey.

Respondent and Non-respondent Differences in Other Trip Rates

For respondents, TDS estimates of total trips are generally higher than comparable TTS estimates. TTS non-respondents in all categories reported substantially higher total trip rates in the TDS than in the TTS survey. This is reflected in the total persons trip rates between the two surveys (Exhibit 4.3 to 4.5).

TDS/TTS trip rate comparisons for other home-based trips confirm that overall the TDS reported higher "other home-based" trip rates than the TTS survey. However, seniors reported more "home-based other trips" in the TTS than the TDS, for total persons, respondents and non-respondents.

The TDS "non-home based" trip rates are consistently higher than the comparable TTS rates for both respondent categories. Whereas respondents appear to understate non-home based trips by approximately 30 per cent, non-respondents understate these trips by approximately 60 per cent.

Travel By Time Period

The major differences between the two surveys apply to "other home based" and "non-home based" travel. The TDS provides higher estimates of mid-day travel than the TTS, primarily due to higher non-home based and other home-based trip rates. However, the TDS estimate for the PM peak is somewhat lower and less peaked than the comparable TTS estimate. The TDS presents a more complex (and realistic) picture of PM peak period travel than the TTS, with fewer work-to-home trips and more non-home based and other home based "linked" trips.

2.4 TDS VALIDATION

The Trip Diary Analysis project also reviewed the TDS Version 1.1 data to assess its accuracy, compared to other data sources, and to evaluate the usefulness of the data for the intended planning and research applications. The TDS validation exercise is documented in Chapter 5. The principal findings of the TDS validation exercise are presented below.

Demographic/Socio-economic Analysis (Exhibit 5.1 To 5.9)

Based on the analysis of household and demographic characteristics for the TDS survey, compared to 1986 Census and TTS, great care should be taken in using TDS based estimates of persons or trips by Region or any smaller area. The under-representation of larger households and the boundary problems associated with the use of postal codes in defining the sample strata, lead to significant estimation errors for the Regional Municipalities outside Metro. The population count for Metropolitan Toronto is reasonable.

Based on our analysis of age structure characteristics and labour force participation rates, the TDS results are representative and provide relatively accurate estimates of these characteristics. However, the TDS sample tends to be biased in terms of income and occupational characteristics, with higher income groups being over-represented. These socio-economic biases would be expected to influence reported travel behaviour.

It appears that lower income residents are under-represented in the Trip Diary sample. At the same time, Professional, Technical and Managerial occupations are over-represented and lower status occupations, such as clerical and service are under-represented. However, all income groups appear to be well represented in the TDS sample and the Diary appears to give an accurate indication of the relative income levels of the residents of Metropolitan Toronto and the other Regions.

Travel Characteristics Analysis (Exhibit 5.10 To 5.16)

TDS estimates of the number of trips attracted to each region which begin in that region are accurate (within 1%) for Metro, Durham and Hamilton-Wentworth, but low for the other Regional Municipalities. It appears that Durham and York residents who work in Metro were more likely to respond to the TDS trip diary survey than persons who work elsewhere. The TDS results also appear to overstate the work travel orientation of Metro residents to York and Halton.

Despite differences in total trip rates, between the TDS and TTS surveys, with the TDS diary yielding more trips in total, the regional travel patterns appear to be very similar (more similar than the work travel data). The higher estimates of "other home-based" and "non-home based" trip making found in the TDS do not appear to affect the distribution of total travel between the Regions.

Overall GTA modal split estimates are generally similar for the two surveys, with home-based work estimates being within 1% for all modal categories except for auto passengers (which are 8.3% of work trips for TDS versus 9.7% for TTS). Auto mode shares estimated on the basis of TDS data are within 3 percentage points for all purposes while transit mode shares are within 1% for work, shopping/personal business, social recreation and non-home based travel.

2.5 ASSESSMENT OF TDS FOR RESEARCH AND PLANNING APPLICATIONS

The TDS survey was designed to provide additional socio-economic and travel characteristics data which could not be collected in the TTS telephone survey. Despite the problems identified in the TDS Validation, the TDS data appear to be ideal for disaggreagate analysis of trip generation and mode split issues.

Work Trip Generation (Exhibit 6.1 To 6.4)

There are definite relationships between occupation and land use, occupation and normal work week and normal work week and land use (at place of work). Regular hours are most prevalent in clerical and professional occupations and, therefore, the same is true for office buildings. Service activities generate fewer work trips on the average weekday, because of an increased incidence of part-time and weekend employment.

Peak Hour Travel Demands (Exhibit 6.5 To 6.9)

It was found that different occupation groups tend to have characteristic start-times and that these effects can be seen for different land uses. For example, compared to the average arrival times for all occupations, factory, construction and transportation

workers arrive earlier. Sales and service workers arrive later, and have distinctive afternoon peaks associated with evening work. Clerical workers, a large group, appear to dominate the AM peak hour. Work and school travel dominates the AM peak hour, but school travel is much more peaked at the Metro and GTA level than for the Central Area during this period.

Modal Choice Behaviour (Exhibit 6.10 to 6.13)

Our analysis of the TDS data confirmed the relationship between occupation and transit use, and illustrated the relatively high transit use by clerical and service occupations within Metro.

The analysis of the TDS data suggests a logical relationship between income and transit use which is evident for home-based work, home-based other and non home-based trips to destinations other than the Central Area. The TDS data also illustrates the role of parking price in explaining mode choice behaviour.

In conclusion, the TDS data base appears to provide an excellent basis for exploring the relationships between land use and trip generation and improving current trip generation and mode choice models.

2.6 LESSONS FOR FUTURE GTA TRAVEL SURVEYS

The final objective of TDS was to evaluate the strengths and weaknesses of the two survey methods and assess how the Trip Diary Survey could have been improved, considering design, conduct, coding and data entry/clean-up.

Strengths and Weaknesses of Telephone and Diary Methods

Both telephone and mail-back surveys have characteristic strengths and weaknesses. Self-reporting mail-back surveys which ask for detailed travel data, such as the TDS, are more difficult to respond to than telephone surveys for persons who are not fluent in English and are not used to filling out forms. Therefore, mail-back surveys can under-represent lower income groups and non-English speakers. Also, self-reporting questionnaires, no matter how carefully designed, are subject to respondent errors and omissions.

Telephone surveys appear to be relatively expensive, compared to mail-back surveys, given the need to employ interviewers to call sample households and incur substantial overhead costs. However, the cost differential depends on the nature of the follow-up procedures followed in the two surveys and a full accounting of the coding and editing costs.

Survey Design Issues

The TDS was designed to up-date TTS travel information and collect additional data for TTS respondents. In retrospect, the cost and time-savings associated with not having a household record attached to the questionnaire (it was assumed that households would not change significantly between the two surveys) appears to have created more costly response and editing/clean-up problems. Generally, the TDS survey form appears to have worked quite well.

Sample Design Issues

The TDS stratified sample design is discussed at length in this report. Because this design failed to ensure that an adequate number of samples were drawn from each of the 96 strata, the benefits of stratification were not achieved. We feel that the weighting procedure which was employed compensates for the sample design but does not over-come the sample allocation problems inherent in the use of postal codes. The absolute estimates of households, population and trip making are biased as a result of the sample design.

Execution of TDS

The execution of the TDS showed inadequate follow-up and failure to code some of the information which had been collected. Households which failed to return forms for all household members should have been contacted. Also, an additional mail or telephone follow-up should have been attempted to increase overall response rates and to collect missing data. The coding functions of the TDS were performed by two separate teams: manual coders and geo-coders. This separation created confusion and resulted in errors.

Future Surveys

The decision as to which survey method (mail-back or telephone) is appropriate for future GTA travel surveys will depend on how well each method serves the objectives of the survey and the relative total costs (considering data collection, coding and editing). The design of any future mail-back surveys should be carefully considered, based on the experience of the TDS and then thoroughly pre-tested. Careful survey design (with thorough in-field pre-testing) will improve response rates and minimize respondent errors and omissions.

Annexe 9

UNIVERSITY OF TORONTO
JOINT PROGRAM IN TRANSPORTATION

Metropolitan Toronto

EMME/2 Development Project

Final Report

January 1990

Contents

1.0 Summary

1.1 Background

EMME/2 is a computer software package for the analysis of the operation of road and transit networks, modelling of future transportation demand and testing of alternative network configurations. The package was originally developed at the University of Montreal and is now distributed by INRO Limited.

The decision in 1988, by the Metropolitan Toronto Planning Department, to purchase the package was the result of an evaluation study carried out by Dr. Eric Miller of Transmode Consultants Inc. An EMME/2 Model Development Advisory Committee was established in November 1988 with representation from the following agencies and consultants:

- Metropolitan Toronto Planning Department
- Toronto Transit Commission
- Ministry of Transportation
- Tranplan Associates Ltd.
- Dr. E. Miller
- Data Management Group

A subsequent proposal from the Data Management Group at the University of Toronto resulted in the setting up of a demonstration project funded jointly by Metropolitan Toronto and the Ministry of Transportation. The demonstration project included the implementation of a multi-user version of EMME/2 on a central computer at the Data Management Group with remote access via regular telephone lines to City Hall and the Ministry. The primary objectives of the demonstration project were established as:

1. The development of base regional road and transit network data in EMME/2.
2. The calibration of network parameters and assignment procedure using Transportation Tomorrow Survey data.
3. Evaluation of the operation of the central computer system.

Metropolitan Toronto was also given an assurance that the demonstration project on completion would result in there being at least as far along in network and model development as they would have been if they had proceeded with an in-house micro-computer version of EMME/2. In the

event of the operation of the central computer proving unsatisfactory the Data Management Group was to arrange for replacement micro-computer equipment, EMME/2 licence and to generate appropriate versions of the networks to run in the micro-computer environment.

1.2 Results

The demonstration project was successful in achieving all of its objectives. Results included the following:

A. The operation of EMME/2 on the central computer (a Hewlett Packard 9000 model 825) proved to be superior to micro-computer versions in terms of speed of operation, capacity, reliability and the flexibility for multiple simultaneous operations. The remote access capability also proved to be fast and reliable.

B. Base road and transit networks were created at an appropriate level of detail to meet the needs of the Metropolitan Toronto Planning Department.

C. The network data and assignment procedures were validated through assignment of Transportation Tomorrow Survey Data and 1986 Census data. These assignments also demonstrated a high degree of consistency between those two data bases, cordon counts and transit ridership data.

The Project went beyond the original terms of reference in three respects:

i) The extent and level of detail of the networks created were greater than originally planned by Metro. The road network contains all of the information used in previous modelling studies by the Regional Municipalities of Durham, York, Peel and Hamilton-Wentworth. It can therefore serve as a base for future planning studies by the Ministry and municipalities outside Metro.

ii) The operation of the central computer has advanced beyond the demonstration phase. The City of Toronto is now a full partner in its operation with their own remote access equipment. A consultant is also using a remote access terminal to perform a study for the Ministry of Transportation. The cities of Scarborough and Etobicoke are interested in gaining access. Outside Metro interested agencies include the Regional Municipalities of Durham and York, the City of Burlington and the Town of Vaughan. GO Transit is interested in becoming a major user. Over 50 people from 21 different agencies have attended training sessions in the use of EMME/2.

iii) A structure has been put in place for the development of modelling procedures. A consultant has used it to produce forecasts for the year 2001 in a Ministry related study. EMME/2 has been identified as a candidate for use in a number of Metro related studies currently in their early stages of development. These include the Sheppard/Finch corridor study, the Sheppard Avenue environmental assessment, the Leslie Street extension environmental assessment and the Harbourfront LRT extension.

The results of this project are likely to provide significant benefits to all agencies involved in transportation planning, both within Metropolitan Toronto and in the surrounding regions. Metro deserves to be congratulated on the leadership role that they have played in initiating and supporting this project.

1.3 Recommendations

1. That the operation of the central computer at the Data Management Group be continued.

2. That Metro Toronto continue to facilitate and coordinate access to the system by area municipalities within Metro Toronto.

3. That Metropolitan Toronto use its membership in the Toronto Area Transportation Planning Data Collection Steering Committee to support the maintenance of base networks, the operation of the central computer and the further cooperative development of EMME/2 related procedures as part of the base function of the Data Management Group.

4. That, in the event of the operation of the Data Management Group being terminated prior to December 31st, 1992, the Data Management Group will undertake to obtain a licence for a micro-computer version of EMME/2, and to supply the necessary equipment to run it. This is assuming that no other agency is willing to take over the operation of the central computer under the same terms and conditions.